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TREES OF NORTHEASTERN UNITED STATES
NATIVE AND NATURALIZED

TREES OF NORTHEASTERN UNITED STATES

NATIVE AND NATURALIZED

REVISED AND ENLARGED
EDITION

BY

H. P. BROWN, PH. D.



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DEDICATION

TO MY PARENTS FROM WHOM I INHERITED MY
LOVE OF THE GREAT OUT-OF-DOORS AND OF
TREES IN PARTICULAR, THIS BOOK IS AFFEC-
TIONATELY DEDICATED

PREFACE

This text has resulted from the revision of Technical Publication No. 15 of the New York State College of Forestry, Syracuse, N. Y., which appeared in February, 1921, under the title of "Trees of New York State, Native and Naturalized". The objectives sought in preparing the original bulletin were to stimulate the interest of the people of the State in its forest wealth and to place at their disposal information relative to the many tree species which grow within its boundaries. That the publication apparently accomplished its purpose is indicated by the many copies which have found their way into private hands. In fact, the demand for it was such that it has been out of print for several years.

From time to time the author's attention has been directed to the fact that the interest in the original bulletin has been consistently maintained, as indicated by the many inquiries concerning it. This possibly may be ascribed in some degree to the continued popularity which the original publication enjoyed but is largely occasioned by the increasing forest-mindedness of the public. This situation undoubtedly is to be explained in part by the fact that the forestry movement of late has gained greater impetus through increases in federal and state grants; these must be paid by taxation and what the public buys, it seeks to understand. Too, the recreational value of the forests has come to be better appreciated and this has served to engender a greater interest in trees. All things considered, it has therefore seemed advisable to republish this text in the hope that it will prove a serviceable book deserving of a niche in the literature upon trees. To give the text wider scope and greater usefulness, the title has been changed to "Trees of the Northeastern United States," with such changes and additions in the manuscript as were necessary to make this title applicable.

In writing the original bulletin, no contention was made that the field was a new one. The information included can be found in the larger and more comprehensive 'tree' manuals covering the trees of the United States or of more restricted regions within its boundaries. Unfortunately, however, many of these manuals are not readily accessible to the public because of the cost and are frequently of such a technical nature as to render their contents difficult of interpretation without special training. Furthermore, the scope of these texts is often so broad as to raise the question as to what information applies specifically to

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the northeastern states. The present text, covering the trees of this region only, omits much irrelevant information which might otherwise confuse.

In the treatment of the subject in hand, it has seemed wise to include not only those trees which are conceded to be native to the Northeast but also those which have become naturalized in this region and propagate themselves in the wild condition. Listed among these are such foreign trees as Scots Pine, Golden Willow, Crack Willow, *Paulownia*, etc. or trees introduced from other parts of the United States as Osage Orange and the Catalpas. Ornamental trees which are never found as 'escapes' are omitted as are such species which are shrubby within the range of the text but arborescent elsewhere. In some cases, the author has been in doubt as to just where to draw the line. The treatment throughout must be considered as conservative.

There are within the borders of the northeastern states approximately one hundred and fifty kinds of native and naturalized trees exclusive of *Crataegus*.* One hundred and fifty-two are figured in this text including three species of *Crataegus*;** of the former one hundred and eighteen may be considered as native trees and thirty-four as naturalized either from other portions of the United States or from abroad. Over two hundred species of *Crataegus* have been described from this area but these exhibit such a multitude of bewildering forms as to be beyond the scope of the text. The inclusion of *Crataegus* brings the total number of arborescent species native to the Northeast to over three hundred and ranks this portion of the country as one of the richest in the Union in its arborescent flora. Woody plants which are obviously shrubs or lianas are not included in this publication.

The descriptions accompanying the plates are based on fresh or herbarium material, or both, available at the New York State College of Forestry or in the herbarium of the Department of Botany, Syracuse University, and were verified by descriptions appearing in Sargent's Manual of the Trees of North America, Sargent's Silva, Rehder's Manual of Cultivated Trees and Shrubs, Britton's North American Trees, Hough's Handbook of the Trees of the Northeastern States and Canada, Gray's Manual, Bailey's Cyclopaedia of Horticulture, and various other publications. I was especially indebted in the preparation of the original edition to Dr. W. C. Coker of the University of North Carolina, to Dr. J. S. Illick, formerly State Forester of Pennsylvania and now on the staff of the New York State College of Forestry, to

* The count will vary somewhat depending upon whether 'varieties' of species are included.

**Two of these species are common native trees; the third is an European species which has become widely naturalized.

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Mr. Henry Hicks of Westbury, Long Island, and to Mr. C. Leo Macy of Princeton, New Jersey, for assistance in collecting material of trees which grow along the southern border of New York State. This list should now be augmented by the names of Dr. A. Rehder and Mr. E. J. Palmer of the Arnold Arboretum, Dr. W. C. Muenscher of the Department of Botany, Cornell University, and Dr. Homer D. House, State Botanist of New York, who have supplied information used in the revision of the manuscript. Thanks should also be extended to Dr. M. A. Chrysler of Rutgers University, Mr. E. C. Pyle of the Pennsylvania Department of Forests and Waters, Mr. E. S. Cary, Forester for the Pocono Lake Preserve, and Mr. R. E. Horsey of Highland Park, Rochester, N. Y., for supplying fresh material used in the preparation of new plates for the revised edition.

The drawings in the first edition were all made by Dr. J. Elton Lodewick, a graduate of the College of Forestry, to whom I am grateful for the zeal and loyalty which made the original text possible. Except in rare cases they were drawn directly from fresh material collected at Syracuse or sent to the College upon request; they were personally checked by the author. The new plates in the second edition were drawn by Mr. L. E. Partelow* of the College, from fresh material.

Grateful acknowledgment is due my colleagues, Drs. C. C. Forsaith and W. M. Harlow, who have assisted me with many helpful suggestions.

In conclusion, I am pleased to express my gratitude to all others who have in any way contributed to the original text or to its revision. Not least among these is the late F. Franklin Moon, former Dean of the College, whose kindly interest in this project from the first helped to bring the first edition to a successful conclusion. I have always met with a ready response from my students and friends in the collection of material and data on trees and extend to them my sincere thanks.

H. P. BROWN.

* The initials at the bottom of the plates indicate work done by these men, respectively.

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Trees of Northeastern United States

PLANTS COMPARED TO ANIMALS

Since this bulletin is concerned with trees and trees are plants, the proper use of it entails the right concepts as to what a plant is, its relation to other plants and animals, and to its environment. The following paragraphs are devoted to a discussion of these topics. While the information thus imparted is treated in a general and cursory way and is likely to prove uninteresting, a proper conception and understanding of plants, and of their classification and general morphology is absolutely essential if one would glean the most from the descriptions which follow in the text.

People who are not conversant with plants and their life activities are prone to place them in a category entirely apart from animals. They do not think of them as living organisms which, like animals, must meet the vicissitudes of a varying, shall I say even hostile, environment, but more of the nature of inanimate objects, bound through the nature of things to one spot, capable of growth, 'tis true, but insensate to most of their surroundings. It may be conceded that the higher plants do lack motility. They do not respond instantly to aggression by teeth or claws or flight. Nevertheless the response is none the less sure, though less immediate. It may continue over days or months or years, but it is none the less certain. Plants differ from animals strikingly in being more plastic to their environment. Once the idea of plant dynamics is thoroughly ingrained the study of plants becomes not a toilsome journey in the identification of the inanimate, but rather a fascinating vista which beckons us onward to greater discoveries and a happier understanding of the power of the Infinite.

Life on this planet is absolutely dependent on the activities of green plants for it is in the green parts of plants that food in its elementary stages is manufactured from the elements.* There are plants which lack this green pigment, chlorophyll, but these exist either as parasites or saprophytes on organic matter previously elaborated. There are herbivorous and carnivorous animals. But these in turn are wholly dependent

* A few exceptions occur in the case of certain bacteria which build up compounds by chemo-synthesis.

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for their existence on the metabolic processes which go on in the green portions of plants. The basis of all life, be it plant or animal, is that living substance known as protoplasm, and protoplasm requires carbon for its nutrition. In fact carbon is one of the essential constituent elements of that substance. But free carbon in any of the forms in which it occurs in Nature cannot be directly assimilated by plants. Nor is the carbon dioxide which results from combustion absorbed directly in the processes of metabolism. It is first combined chemically in the plant tissues with hydrogen to form sugar or starch. Subsequently other organic compounds are elaborated from these by the protoplasm through a readjustment of molecules, and hence molecular weight, and by the addition of other elements such as nitrogen, sulphur, phosphorus, etc. The ultimate origin of all the organic compounds which are found in Nature is in the green parts of plants. Plants possess the ability which animals lack of manufacturing complex organic compounds from carbon dioxide and water.

The gulf which separates the higher plants from the higher animals is obvious—so obvious in fact that one can never mistake the one for the other. The animal possesses motility; it has a highly developed nervous and circulatory system. Its tissues, aside from the bones, are soft and plastic. It is wholly dependent for its food on compounds elaborated by plants or, in the case of carnivores, in the bodies of other animals. The plant, on the other hand, is compelled to spend its whole life in one place. It lacks a nervous system and while there is a circulatory system this is less specialized, and utilized wholly in the movement of plant foods and water. Its tissues are firmer than those of the animal and differ in their chemical composition. The plant possesses leaves which contain the green pigment chlorophyll, thus permitting it to manufacture its own organic food.

But science tells us that the higher plants and animals have been derived from lower, less complex forms, the simplest of which are unicellular. Some of these simple plants are motile. Others, as the bacteria and fungi, are without the green pigment chlorophyll. The simple animals lack a nervous system worthy of the name and many engulf or swallow their food bodily. Others possess chlorophyll granules whose origin is still a matter of dispute. We are forced to the conclusion that there is no sharp dividing line between plants and animals. Differences which obviously separate the higher plants from the higher animals will no longer suffice. The simple forms of plants and animals intergrade.

TAXONOMY OF PLANTS

Taxonomy comes from the Greek νόμος and τάξις, meaning respectively 'law' and 'arrangement,' and is concerned with the logical arrangement of related things and the laws and principles governing that arrangement. Thus we may have the taxonomy of mollusks, insects, worms, fishes, etc., in fact, of any group of organisms or of related things. The taxonomy of plants deals with the kinds of plants (identification), their nomenclature, and their classification.

NOMENCLATURE OF PLANTS

Plants have one or more so-called common names and a scientific name. The common names usually designate some peculiar feature or characteristic of the plant, the habitat where found, resemblance to some previously known form, or some use, often mythical, to which the plant may have been put. Willow Oak signifies the oak with willow-like leaves. Shining Willow designates the willow with shiny leaves. Swamp Poplar is found in swamps. Paper Mulberry refers to the mulberry, the bark of which is manufactured into paper. *Hamamelis virginiana* L. is known under the common name of Witch Hazel owing to the reputed value of its twigs in colonial times as divining rods to indicate deposits of precious metals and veins of water.

But common names at best are very confusing. Ironwood in eastern United States may refer to *Ostrya virginiana* (Mill.) K. Koch, or *Carpinus caroliniana* Walt. In Australia it is applied to woods belonging to trees of such widely separated families as the *Leguminosae* and *Myrtaceae*. In Burma, *Xylia dolabriformis* Benth. goes under the name of Ironwood. The Ironwood of Ceylon and India is *Mesua ferrea* L. Added to the above is the confusion resulting from the use of different languages. The Maple is known as Ahorn in Germany, as Erable in France, as Arce or Meple in Spain. Scientific names are the same the world over. They are derived from the Latin or Greek and take Latin endings. Latin is a dead language and the rules which govern its syntax never change. *Pinus strobus* L. will mean the same to a botanist now or a hundred years from now, be he Russian, German, Italian, or English.

A scientific name consists of three parts, a **genus** name (plural-genera) which is always capitalized, a **species** name (plural-species)

which may or may not be capitalized, and the abbreviation of the name of the man who is given credit for first describing the plant. The common Sugar Maple is *Acer saccharum* Marsh. while *Acer rubrum* L. signifies Red Maple. In general practice it is customary to omit the abbreviation of the author's name. The proper use of scientific names* may be well illustrated with the oaks. The various oaks all are assigned to the genus *Quercus*; in other words, they are different species of this genus. In the United States alone we have some eighty species which are designed by different scientific names as *Quercus rubra*, Southern Red Oak; *Quercus coccinea*, Scarlet Oak; *Quercus phellos*, Willow Oak; etc., each with the abbreviation of the author's name after the 'species' name.

Generic and specific limits are more of a conception than a definite thing. Man aims at a natural classification, that is, one which indicates natural relationships, but the boundaries thus laid down may not be of those of Nature. Plants which resemble each other as closely as the offspring of common parents are generally conceded to belong to the same species. A genus may contain but one species as in the case of *Ginkgo biloba* L., the Maidenhair Tree, or a hundred or more as in the case of *Salix* (Willow) where about three hundred species are recognized. The actual number of species assigned to a genus depends largely on whether the systematist is radical or conservative in his ideas. Unfortunately botanists often differ widely in their conceptions of plant relationships, especially as regards the limits of species.

In some cases the differences between plants are so slight as to render their separation into different species unjustifiable. It may be a difference in stature or in the size and shape of the leaves or fruit which a different environment has occasioned. For example, the Paper or Canoe Birch of the northern United States and Canada differs from the European White Birch in its greater size and larger leaves. In its other characters it resembles the European species quite closely and some conservative systematists have considered it but a variety of the European form and have listed it as *Betula alba* var. *papyrifera* (Marsh.) Spach.

The selection of the scientific names of plants depends upon a com-

* For the derivation of the scientific and common names used in this text, the reader is referred to the glossary on page 455. They may be derived from any of the following sources: (a) An ancient common name (Latin, *Quercus*) or aboriginal name (Indian, *Powcohiccora-Hicoria*); (b) the name of the geographical locality (continent, *Prunus americana*; country, *Tauga canadensis*; state, *Quercus marilandica*; city, *Picea sitchensis*; river, *Celtis mississippiensis*; etc.), from which the plant originally came; (c) habitat (Latin, *mons*—mountain and *colere*—to dwell, *Pinus monticola*); (d) the name of the discoverer or some person associated with the discovery, or in honor of some person (*Mac-lura*—Wm. Maclure, an early American geologist); (e) some peculiar feature of the plant (Latin, *nigra*—black, *Salix nigra*).

NOMENCLATURE OF PLANTS

plex system of rules based mainly on considerations of priority. Conservative botanists in this country are following a universal code of nomenclature according to a set of rules promulgated at the International Botanical Congress, held at Vienna, June, 1905.* The Vienna Code considers the first edition of Linnaeus' *Species Plantarum* of 1753 as the logical starting point for the nomenclature of the higher plants and adopts the generic names used by Linnaeus in his text. These were in part coined by Linnaeus himself and in part adopted by him and his followers from pre-Linnean authors. In the adoption of post-Linnean generic names, priority rules. The Vienna Code likewise adopts the earliest specific name used to designate a plant rather than that specific name which was first combined with the correct generic name. *Sassafras variifolium* (Salisb.) Ktze. indicates that Salisbury first applied the specific name of *variifolium* to the *Sassafras* tree but used it with a different generic name. Kuntze was the first to use the specific name of *variifolium* correctly with the generic name, *Sassafras*.

CLASSIFICATION OF PLANTS

The ultimate aim of botanists and zoologists in the classification of plants and animals has been to devise a "natural system" of classification which would best indicate the natural affinities of related forms. Such a treatment is both logical and practical in that related forms are thus brought down together in congeries which permit of their identification and study with greater ease. Experience has taught that in the higher plants variation in the flower offers the best basis for a "natural" classification. Plants exhibiting likeness or parallelism in floral structure are found to share other characteristics in common which indicate clearly their common lineage. It is customary to consider those plants first which are conceded to have the simplest or most primitive flowers, thence to proceed to forms with greater specialization, considering those last which have the most complex flowers. The system is open to criticism in that it is sometimes difficult to determine whether a flower is inherently primitive in structure or simple by reduction.

In classification plants are first divided into large divisions which have certain gross features in common, then successively into smaller divisions, and ultimately into genera and species. The characters enumerated under successive divisions are increasingly specific and of narrower latitude. The divisions of such a classification are listed below;

* There is also a Rochester and an American Code.

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clarity is rendered more certain by classifying the cordate-leaved variety of the Paper or Canoe Birch according to this plan:

| | |
|-------------|---|
| Kingdom | Vegetable |
| Division | Spermatophyta |
| Subdivision | Angiospermae |
| Class | Dicotyledoneae |
| Subclass | Choripetalae (petals distinct or wanting or only some of the petals united at the base) |
| Order | Fagales |
| Family | Betulaceae |
| Subfamily | Betuleae |
| Genus | Betula |
| Species | <i>papyrifera</i> |
| Variety | <i>cordifolia</i> |

The Vegetable Kingdom is divided into four Divisions, viz.:

| | |
|----------------|--|
| Thallophytes | .. algae, fungi, bacteria, etc. |
| Bryophytes | .. liverworts and mosses. |
| Pteridophytes | .. ferns, scouring rushes, horsetails, club-mosses, and quillworts. |
| Spermatophytes |all seed plants, including conifers and deciduous-leaved trees. |

A proper conception of the limits of these groups will lead to a better understanding of trees and the relation which they bear to other plants.

Thallophytes constitute the lowest division of the vegetable kingdom and include the simplest forms of plants. The plant body or thallus exhibits little variation or specialization in structure (though often a wide range of form) and usually carries on its life activities either in water or on a moist substratum. Included in this group are the *algae* (pond scums, seaweeds, etc.), and the *fungi* (mushrooms, bracket fungi, etc.), both of which exhibit a remarkable variation in the form and size of the thallus but extreme simplicity in its structure. Many of the simplest Thallophytes are unicellular and some are free swimming and resemble minute animals. Sexuality has become well developed in many forms while in others it is totally lacking.

Bryophytes are best represented by the mosses although a second group, the liverworts, is also included. The Bryophytes show a distinct advance in specialization over the Thallophytes. This is evinced through the definite establishment of a sexual stage in which the sexes may be distinguished, and an "alternation of generations" whereby a sexual stage or generation is followed by a semi-dependent, asexual stage which in turn again gives rise to sexual forms. While more specialized than Thallophytes, Bryophytes are, relatively speaking, simple plants. The plant body is an elementary structure which possesses chlorophyll

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and is in some cases thalloid, while in others it develops a primitive stem and leaves. True vascular tissue (vascular bundles) is entirely lacking.

Vascular plants make their appearance for the first time in the Pteridophytes, a group which includes the true ferns and what are recognized as fern allies, the horsetails, scouring rushes, club mosses, and quillworts. True roots, stems, and leaves equipped with special conducting or vascular tissue, have become established as definite structures and function as in the seed plants. As in the Bryophytes there is a sexual stage in which the sexes may be distinguished but the sexual organs have become increasingly specialized. This is followed by an asexual stage in which sexless individuals through spore formation again give rise to sexual forms. In the higher Pteridophytes it is the asexual or sporophytic stage that has become dominant while the sexual generation has been relegated to an obscure, independent existence or has become actually parasitic on the asexual generation. Pteridophytes were formerly represented by a vast assemblage of plants many of which were arborescent and flourished during the Carboniferous period, contributing largely in the formation of our coal deposits of today. Owing to an altered environment and the development of seed plants which are better adjusted to withstand modern conditions the group is now on the wane and is represented only by some 4000 species.

The dominant plants of today are the seed plants or Spermatophytes. They represent the highest type of specialization, though not necessarily the final type. Like the Pteridophytes they bear true roots, stems, and leaves and have an independent asexual or sporophytic stage on which the sexual or gametophytic stage is wholly dependent. The most striking difference lies in the formation of seeds which are dormant structures representing a pause in the development of the new sporophyte, designed by Nature to tide the plant over unfavorable periods and to insure a wider dissemination. Sexuality is a necessary part of the life cycle and is insured through the transfer of male elements to the proximity of the female nuclei by means of pollen grains. Following the union of the sex nuclei made possible by the formation of a pollen-tube which serves as a siphon, a young sporophyte or embryo is formed within the ovule or developing seed which, as the latter matures, passes into a dormant condition. Upon subsequent germination of the seed, the young sporophyte again assumes an active existence.

The Spermatophytes in turn are divided into two subdivisions, the Gymnosperms and the Angiosperms, which are distinguished by the manner in which the seeds are borne. The word gymnosperm is derived

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from the Greek γυμνός, meaning naked, and σπέρμα, seed, and includes those Spermatophytes in which the seeds are not enclosed in an ovary but are borne naked, subtended by scales or fleshy structures. Angiosperm comes from the Greek ἀγγεῖον, meaning vessel, and σπέρμα, seed, and embraces those forms in which the seeds are borne enclosed in an ovary which may or may not dehisce at maturity. The boundary between the two groups is sufficiently clear to serve the purposes of classification although it in no way indicates the disparity in numbers and size.

Gymnosperms are very ancient and form but a small part of the present seed-plant vegetation. Some 650 living forms exist today which are to be regarded as the surviving remnant of a vast phylum which had its genesis in the Carboniferous and flourished during the Triassic. Angiosperms were evolved comparatively recently (lower Cretaceous) in a geological sense and now are represented by a vast assemblage of at least 150,000 species which comprise the bulk of the seed-plant vegetation of the present day. They have been able to attain and hold the ascendancy over the other groups because of adaptive features which they have developed to meet the environmental conditions in force at the present time. The most obvious features which set off this group from the Gymnosperms are the presence of the flower with its showy perianth, stamens and pistil and the manner in which the ovules or immature seeds are borne enclosed in an ovary.

Two classes of Angiosperms are recognized, the Monocotyledons and the Dicotyledons, which are characterized as follows:

(a) Monocotyledons possess but one seed leaf or cotyledon which is terminal on the axis; dicotyledons possess two seed leaves which are lateral.

(b) The vascular bundles of monocotyledons are scattered in the stem; those of the dicotyledons are arranged in a ring, or the stem contains a vascular cylinder enclosing a pith.

(c) The leaves of the monocotyledons possess closed venation, that is, the veins do not end blindly in the margin which, as a result, is entire; dicotyledons possess leaves with open venation and the margin is often dissected.

(d) The flowers of the monocotyledons are chiefly 3-merous, that is, the floral parts are arranged on a plan of 3; those of the dicotyledons are predominately 4- or 5-merous.

Formerly monocotyledons were believed to be more primitive because of the greater simplicity of their floral structure. However, modern science has demonstrated that dicotyledons are of more ancient origin

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and that monocotyledons undoubtedly arose from them as an aberrant off-shoot in comparatively recent times.

The monocotyledons include at least 30,000 species and are arranged in seven orders embracing about 48 families. The larger division, the dicotyledons, embraces thirty orders, some of which are represented wholly by herbaceous forms, while others consist wholly of woody plants or of both woody and herbaceous species. For convenience the first twenty-one orders of dicotyledons are sometimes listed as *Choripetalae* (*Archichlamydeae*) and include those forms which have either no petals (*Apetalae*), or petals entirely separate or some only united at the base (*Polypetalae*), a condition of the perianth (chlamys) which is conceded to be primitive. The remaining nine orders are characterized by a gamopetalous corolla and are included among the *Sympetalae*.*

Gross flower characteristics usually distinguish the orders while minor floral characters are used to separate families and genera. An order may contain but one family or—as is generally the case in the large tropical orders—a number of families. Order names end in the Latin feminine plural “ales,” as for example, the *Salicales*, *Fagales*, etc. This literally signifies “plant families related to the willow family,” etc.

Family names generally end in “aceae,” which is the feminine plural of the Latin suffix *aceus*, meaning “like or related to.” The family name is really an adjective agreeing with the understood noun “*Plantae*,” as *Plantae Fagaceae*, *Plantae Oleaceae*, etc. Family names are commonly coined by prolonging the name of a genus of the group taken as a representative of it. For example, *Fagus* is a genus belonging to the *Fagaceae*, *Acer* to the *Aceraceae*, etc. Some family names have a different origin which indicates the type of fruit prevailing, the manner in which the flowers are borne, or some other prominent feature of the plant. For example, the large tropical family, the *Leguminosae*, is so named because the fruit is a legume, while the flowers are always in umbels in the *Umbelliferae*.

The generic name of a plant is one word and substantive. Commonly it is the old classical name used by the Greeks and Romans as *Fagus* for Beech, *Acer* for Maple, *Corylus* for the Hazel, etc. Or it may be derived from some peculiarity of the plant as *Liriodendron* which comes from the Greek λείριον, meaning lily, and δένδρον, tree, referring to the lily-like flowers of this species. *Gymnocladus* means literally “naked branch” and refers to the stout branches of the trees included in this

* The figures in this paragraph are based on the Engler and Prantl system which has been accepted for most modern American floras. The number of orders and families given under the various divisions by other authors vary widely; for example, Hutchinson lists the *Choripetalae* as embracing 75 orders and 213 families, the *Sympetalae* as including 17 orders and 50 families, and the *Monocotyledons* as containing 29 orders and 68 families.

genus which bear sparse foliage. Other genera are dedicated to distinguished botanists or in honor of some person or of the discoverer of the plant. *Robinia* is named after John Robin, the first to cultivate a species of this genus in Europe; *Magnolia* is from the surname Magnol, in honor of Peter Magnol, a botanist of the 17th century. Generic names take the ending of the Latin nominative case.

The specific name is also a single word, appended to that of the genus. It is generally an adjective and agrees with the generic name in case, gender, etc. In general the generic names of trees are of feminine gender and require specific names with feminine ending, but exceptions to this rule occur, especially where the generic name was the ancient name of the plant. For example, *Acer* was the Latin name of the maple, is of neuter gender, and is followed by specific names with the endings of this gender.

Specific names* may denote (a) the locality (country, province, state, city, river, etc.), or habitat from which the plant originally came as *Ostrya virginiana*—from Virginia, *Salix babylonica*—from Babylon, *Picea sitchensis*—from Sitka, Alaska, *Quercus palustris*—from *palus*, swamp, referring to the low-land habit of this species; (b) some peculiar feature of the plant as *Salix purpurea*—referring to the purple branches, *Maclura pomifera*—referring to the large, pome-like fruits of the Osage Orange; (c) the name of the discoverer, or in honor of some botanist or person as *Quercus Michauxii*, for the surname Michaux, and referring to F. Michaux, one of the earlier dendrologists; (d) an ancient name, as *Pinus strobus*, *strobus* being Latin and referring to a cone or something twisted. A substantive name when used specifically may not accord with the generic name in gender.

For the derivation of scientific names used in the text, the reader is referred to the glossary on page 455.

Varietal names, where necessary, follow the same plan as specific names, and take the same endings. They are written thus: *Betula papyrifera* var. *cordifolia* Fern. or *Betula papyrifera cordifolia* Fern.

Hybridization in trees, that is, the crossing of two kinds of trees is not infrequent in Nature. Usually such crosses are between species of the same genus but intergeneric hybrids, that is, crosses of tree-species belonging to different genera, are known to occur. For a great many years it was customary to designate crosses between closely related species by a combination of the technical names of the supposed parents. For example, the hybrid resulting from the crossing of *Quercus alba* and *Quercus macrocarpa* was designated as *Quercus alba* × *Quer-*

*See footnote, page 18.

CLASSIFICATION OF PLANTS

cus macrocarpa. This method served very well where the parents were known but frequently one or both parents were in doubt. The situation became the more complicated where a tree which later proved to be a hybrid had been described originally under a binomial name, often without the realization of the author of this name that the tree was a hybrid. *Quercus heterophylla* Michx. f. which in reality is a hybrid between *Quercus phellos* and probably *Quercus borealis maxima*, may be cited as a case of this kind. It is now customary to give hybrids binomial names and to indicate the hybrid origin by placing an \times before the generic name, as \times *Quercus heterophylla* Michx. f. If the parents are known, this may be stated by inserting this information after the name of the hybrid. Where the description of the hybrid follows immediately that of one of the parents, parentage of the hybrid is frequently indicated, viz: *Quercus alba* \times *Quercus macrocarpa* = *Quercus bebbiana* Schneid.

CLASSIFICATION OF ARBORESCENT PLANTS

With the exception of a few tree ferns which are classed among the Pteridophytes and are restricted to the tropics, arborescent plants are confined to the Spermatophytes and are represented by both Gymnosperms and Angiosperms. The dendroid Gymnosperms which are of economic importance as timber producers are confined to the order *Coniferales* although *Ginkgo* and some of the Cycads become arborescent. Angiosperms include many monocotyledonous and dicotyledonous species which become trees and grow under manifold conditions and habitats. These are arranged, according to the usual scheme of classification, successively in orders and families. A somewhat arbitrary grouping of the orders into larger artificial divisions, as indicated below, tends for greater clearness and renders the approach to the subject of Dendrology easier for the student. Arborescent Pteridophytes and Monocotyledons are omitted as not being representative of temperate regions. The arborescent plants of the North Temperate Zone may be grouped, for convenience, as follows:

I. *Coniferae* (one order)

II. *Choripetalae* (*Archichlamydeae*) (21 orders and about 180 families)

(1) *Apetalae* (flowers without petals)

(a) Flowers in aments (*Amentiferae*)

(b) Flowers not in aments

(2) *Polypetalae* (flowers with separate petals)

TREES OF NORTHEASTERN UNITED STATES

III. *Sympetalae* (9 orders and about 50 families; flowers with a corolla of united petals)

Coniferae are characterized by (a) leaves which are usually evergreen; (b) seeds borne naked, either in cones or terminally without cone-formation; (c) excurrent trunks; (d) wood without ducts. Represented by forty-six genera and 554 species.

Choripetalae and *Sympetalae*, in contrast, have (a) either deciduous or evergreen leaves (generally deciduous in the range of this text); (b) seeds enclosed in an ovary (base of a pistil); (c) generally deliquescent trunks; (d) wood with ducts.

In the *Choripetalae* the flowers are either devoid of a corolla or have a corolla of separate petals. Plants of the former type are grouped under the *Apetalae* and here again two subgroups are recognized, *Apetalae* with the flowers in aments (willows, cottonwoods, etc.) and *Apetalae* the flowers of which are not borne in aments (elms, hackberry, etc.) As the term implies, the *Polypetalae* consist of plants in which there is a corolla consisting of separate petals.

The *Sympetalae* have many characters in common with the *Choripetalae* but are distinct as a group because, with few exceptions the corolla is sympetalous, that is, is all in one piece. In the exceptions which occur, the plants are still grouped with the *Sympetalae* because they possess other features in common with sympetalous plants. Persimmon may be cited as an example of this group.

The subject matter 'by species' upon the trees covered by this text (pp. 86 to pp. 393 incl.) is presented in the sequence of the preceding table, beginning with the conifers. It is well to note in passing that the *Coniferae* are all woody, and are mainly inhabitants of temperate, alpine, or boreal regions. Many are important timber trees because of (1) the large stature, (2) excurrent trunks, (3) growth in pure stands, (4) inhabitants of temperate regions where industrial activity attains its greatest impetus, (5) even-grained, soft wood which takes nails and is readily worked with tools. The *Amentiferae* are likewise preeminently plants of temperate regions, are all woody, and include in their number such valuable timber trees as oak, chestnut, beech, and birch. The remainder of the *Archichlamydeae* and the *Sympetalae* comprise a heterogeneous group with great diversity of form, interspersed and intimately connected with herbaceous forms and with many tropical affinities.

IDENTIFICATION

The identification of plants may be made from drawings or pictures by turning directly to the illustrations. This is especially true where

IDENTIFICATION

the plant is known to belong to a certain family or genus. The method is cumbersome and open to criticism in that it is unscientific and permits the student to acquire no grasp of the fundamentals underlying taxonomy.

The logical approach to the subject of plant identification lies in the use of previously prepared "keys" based upon morphological characters, which permit finally of the determination of species. Thus one may construct a key for the oaks, the maples, or the ashes, or, in fact, any group of related plants. It is customary for convenience to assemble keys for family, generic and specific identification into manuals which include all plants of certain groups represented in a given area. There are various manuals of this sort which cover the trees of the United States and Canada, or portions thereof; since these would form a very long list, it has seemed inadvisable to cite them by title here.

"Keys," as employed in manuals, are of the dichotomous type, that is, two or rarely more alternatives are presented for consideration, but one of which applies to the plant in question. These alternatives are co-ordinate in rank, are equally spaced from the left-hand margin, and deal with the same topic as illustrated by the simple key which follows:

| | |
|-----------------------------------|--------------------|
| 1. Leaves simple | 2 |
| 1. Leaves compound | 3 |
| 2. Leaves palmately netted-veined | Maple. |
| 2. Leaves pinnately netted-veined | Oak. |
| 3. Leaves palmately compound | 4 |
| 3. Leaves pinnately compound | 5 |
| 4. Leaflets three | Poison Ivy. |
| 4. Leaflets five | Virginia Creeper. |
| 5. Leaflets three to seven | Shagbark Hickory. |
| 5. Leaflets seven to nine | Bitternut Hickory. |

Given: For identification, a plant included in the key, proceed as follows: Note whether the leaves are simple or compound. If simple turn to the alternatives listed under 2; if compound, to those listed under 3. Suppose, for the sake of illustration, we assume that the leaf is palmately compound and of three leaflets: From 1, you would proceed to 3, thence to 4, and finally to the specific determination of Poison Ivy.

It follows that the primary divisions of any key are less specific than the ultimate divisions. The greater the number of species included, the longer is the key. Eventually, by the process of elimination, the various species may be separated from each other.

DENDROLOGY

DENDROLOGY DEFINED

The taxonomy of woody plants as distinguished from herbaceous is called Dendrology. Dendrology means literally the "science of trees," but in general usage it has come to have a broader meaning and to comprise a taxonomic study of all woody plants.

Unfortunately the line delimiting herbaceous and woody plants is not a sharp one as the two types intergrade. Some plants are always woody; others are herbaceous or semi-woody, but on occasion may become woody. Tabulated below are the chief differences which distinguish woody plants, but it must be understood in advance that the information thus imparted must be used with reservation.

CRITERIA FOR DISTINGUISHING WOODY PLANTS

1. Woody plants are perennial, that is, they live from year to year. Annuals complete their life cycle within a season and are tided over the winter by their seed. Biennials may produce stems or canes, as in the raspberry, which are semi-woody the second year, but the two-year life span precludes their inclusion among typical woody plants.

2. Woody plants possess vascular tissue, that is, specialized conducting tissue. Not all vascular plants are woody by any means, as all the herbaceous flowering plants are numbered among the vascular plants. This prerequisite, however, excludes the Thallophytes and Byrophytes from the category of woody plants.

3. Woody plants possess an aerial axis or stem which persists from year to year. In the case of a tree this stem is called the bole or trunk. Many perennials fail to be classed as woody plants because they die back to the ground each autumn, the roots persisting through the winter and producing a new stem the following spring. Other plants, as many of the ferns, possess perennial, creeping stems and are woody plants in a strict sense, but not in the general sense as used in Dendrology.

4. Woody plants possess vascular tissue which becomes "lignified" or woody as it matures. This process of lignification is brought about by certain chemical and physical processes which take place in the

KINDS OF WOODY PLANTS

woody part of the vascular tissue whereby the walls of the cells composing it are rendered harder, stronger and more durable than before. The cells of woody tissues become more or less lignified the first year, soon after they attain their ultimate growth, and the process should not be confused with the changes which occur in passing from sapwood to heartwood. Lignification is in no sense confined to the so-called "woody plants," or, in fact, to vascular tissue. Woody stems possess in proportion more tissue that is lignified than herbaceous plants, and hence seem woody to us.

5. Typical woody plants possess secondary thickening, that is, have a means of thickening their stems by subsequent growth in diameter which is not traceable to terminal growing points. This is achieved through the activities of a growing layer or cambium which is situated just outside the last formed layer of wood and beneath the bark, and produces new wood and new bark yearly which are interpolated between the older wood and bark. This results in the formation of the annual rings which are characteristic of cross-sections of the trees of temperate regions. Tropical trees are often devoid of annual rings because cambial activity extends over practically the whole year and the resulting wood is quite homogeneous.

But there are arborescent ferns and monocotyledons (palms) which are devoid of secondary thickening of the normal type, in that the woody tissue is not gathered together in a cylinder surrounded by a cambium but is scattered through the stem in separate vascular bundles. In such arborescent forms subsequent seasonal increase in the thickness of the stem, where it occurs, may be due to the continued enlargement, over a period of years, of tissues which had their inception in the apical growing point. This explains the fact that many palms support but a given number of leaves in their crown and new leaves develop only in proportion as some of the older leaves cease to function. In other cases, monocotyledonous stems increase in girth through anomalous secondary thickening, that is, not in the typical way. Finally there are many woody monocotyledons, especially lianas, which exhibit little or no secondary thickening, as in the case of *Smilax hispida* Mohl., the Hispid Greenbrier.

KINDS OF WOODY PLANTS

Woody plants are of three sorts, (1) trees, (2) shrubs, and (3) lianas, between which no hard and fast lines can be drawn. A given species may be shrubby near the limits of its range and arborescent elsewhere. For example, Witch Hazel is generally a shrub in New Eng-

TREES OF NORTHEASTERN UNITED STATES

land and New York but becomes a tree farther south and west. Certain species of *Ficus* begin life as lianas but ultimately become arborescent. Again, many woody plants which are reduced to dwarfed, scraggly shrubs in the boreal zone, or at high elevations, attain to the dignity of large shrubs or even trees to the southward or at lower altitudes where they are not forced to contend with such a hostile environment. In general the kinds of woody plants may be defined as follows:

1. A tree is a woody plant which attains a height of at least twenty feet in a given locality and usually (not always) has but a single self-supporting stem or trunk.

2. A shrub is a woody plant which seldom exceeds twenty feet in height in a given locality and usually (not always) has a number of stems. Many shrubs have prostrate primary stems embedded in the soil or leaf-mold which send up persistent secondary branches of fruticose habit. These arise at varying intervals from the horizontal stem and appear as separate individuals.

3. A liana is a climbing woody vine. Lianas climb by twining, clambering, aerial roots, tendrils, etc., and are characteristic features of tropical rain forests. They are represented in our flora by such woody vines as Virginia Creeper, Clematis, Moonseed Vine, and the Wild Grape.

SPECIAL MORPHOLOGY

The use of a tree manual entails an understanding of the morphology of plant parts and of their proper interpretation. The primary basis of classification in trees, as in other seed plants, is the flower, for trees bear flowers as do other plants which produce seed. But the floral stage of trees is a fleeting one at best; floral characters are not available for study except for comparatively short periods. In a taxonomic study of woody plants, other features pertaining to leaves, twigs, fruit and bark are generally stressed at the expense of floral characters. The following pages are devoted to Special Morphology in an endeavor to render more understandable that part of the text which follows:

LEAVES

General

The expanded green structures which make up the foliage of the higher plants, and in which physiological processes necessary to the life of the plant take place, are known as leaves. Foremost among such life activities are (1) photosynthesis or the synthesis of sugar from carbon dioxide and water, (2) transpiration or the voiding of excess water that has been taken up through root absorption, and (3) respiration or breathing.

A foliage leaf always possesses an expanded part or lamina which is specially adapted by internal structure and the presence of breathing

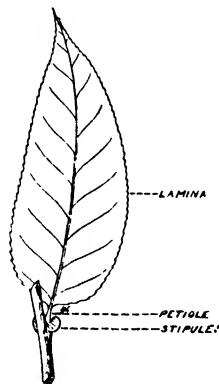


FIG. 1—PORTION OF A TWIG WITH LEAF ATTACHED, SHOWING LEAF PARTS

TREES OF NORTHEASTERN UNITED STATES

pores or stomata to perform the functions assigned to it by Nature. In addition there may be a stalk or petiole which attaches the lamina to the stem, and stipules, inserted separately on the stem at the base of and on either side of the petiole (Fig. 1). A leaf which is devoid of petiole is said to be epetiolate or sessile; a leaf without stipules is estipulate. Stipules, where present, are often apparently vestigial structures and have no real function. In other cases they are modified into thorns (as in the Black Locust) or serve as bud-scales which protect the dormant growing points during the winter (Basswood).

Leaf Variation

Of the primary plant parts, namely root, stem, and leaves, the latter are by far the most plastic and respond most quickly to an altered environment or habitat. Such external stimuli manifest themselves in leaves of various shapes and sizes and result not only in wide differences between the leaves of different species, but even within one and the

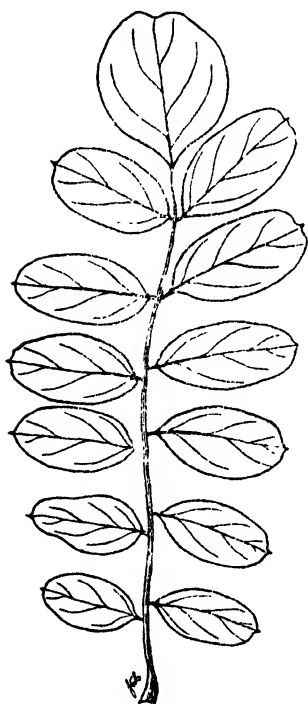


FIG. 2—ODD PINNATELY COM-
POUND LEAF

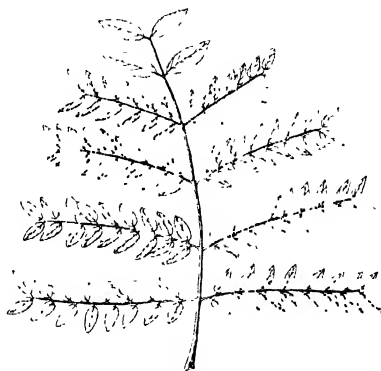


FIG. 3—EVEN PINNATELY DECOMPOUND LEAF

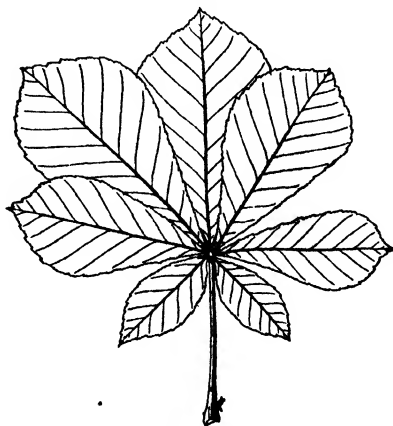


FIG. 4—PALMATELY COMPOUND LEAF

SPECIAL MORPHOLOGY

same species and on the same plant. Variation in the size, shape, margin, etc., of foliage leaves is of the utmost importance in tree identification.

Leaf Classification

A. Leaves classified as to Position (Phyllotaxy)

1. Alternate—one inserted at a node.
2. Opposite—two at a node, inserted on opposite sides of the stem.
3. Verticillate or whorled—three or more at a node.

Alternate leaves are arranged in ascending left to right spirals on the stem and according to a definite plan. The portion of the spiral from one leaf to one directly above it is termed a cycle. Spiral phyllotaxies are represented by the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, etc., in which the numerator represents the number of turns and the denominator the number of leaves in a given cycle.

B. Leaves Classified as to Composition

1. Simple, with undivided lamina. (Fig. 1.)
2. Compound, lamina divided into leaflets.
 - a. Pinnately compound, leaflets arranged along the two sides of the rachis.
 - a¹ Odd pinnately compound, with an odd number of leaflets.* (Fig. 2.)
 - b¹ Even pinnately compound, with an even number of leaflets.
 - c¹ Pinnately decompose, twice or thrice pinnately compound. (Fig. 3.)
 - b. Palmately compound, leaflets radiating from the end of the petiole. (Fig. 4.)
 - a¹ Ternately decompose, palmately decompose with three primary divisions, the ultimate secondary divisions frequently pinnate.

C. Leaves Classified as to Form

1. Acicular, long and very slender; needle-like. (Fig. 5.)
2. Subulate, awl-shaped; short, sharp-pointed, broadened at the base. (Fig. 6.)
3. Linear, narrow, several times longer than wide, and with sides approximately parallel. (Fig. 7.)
4. Oblong, longer than broad, and with approximately parallel sides. (Fig. 8.)

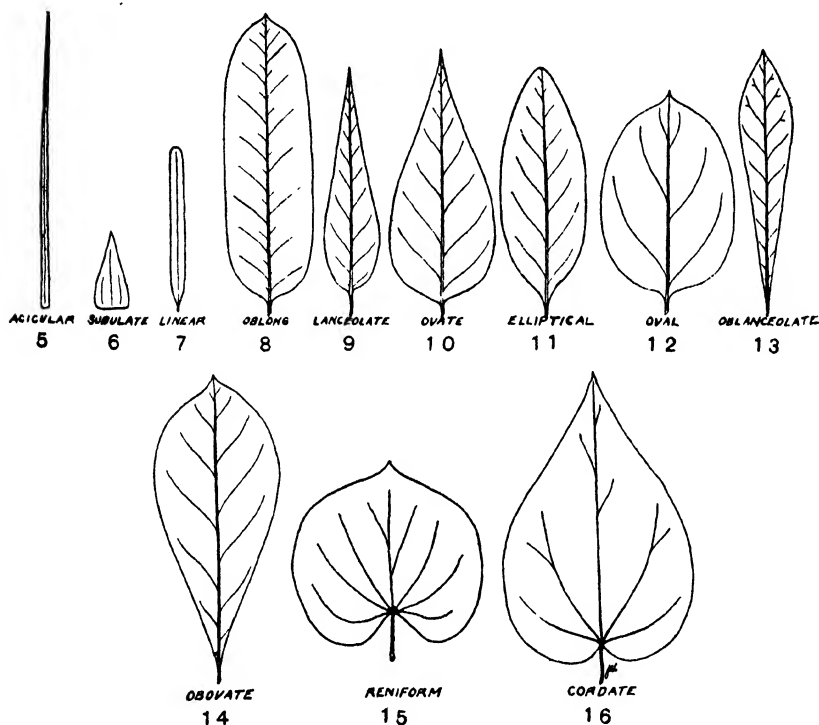
*Leaflets may be borne opposite or alternate on the rachis in (a¹) and (b¹).

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Leaf Classification—Continued

C. Leaves Classified as to Form—Continued

5. Lanceolate, several times longer than broad, broadest about one-third up from the base, and narrowed to an attenuate apex. (Fig. 9.)
6. Ovate, shaped like a hen's egg with the broadest part down. (Fig. 10.)
7. Elliptical, shaped like an ellipse. (Fig. 11.)



LEAF SHAPES

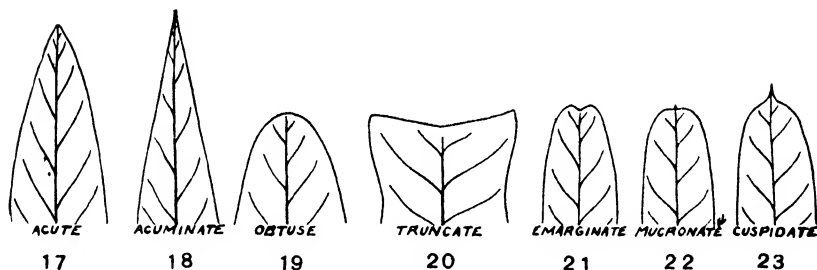
8. Oval, broadly elliptical, with the short diameter more than half the long diameter. (Fig. 12.)
9. Orbicular, circular.
10. Oblanceolate, inversely lanceolate (Fig. 13); obovate (Fig. 14), inversely ovate, etc.
11. Spatulate, shaped like a spatula; rounded above and narrowed below like a spatula.
12. Cordate, heart-shaped, with the point upward. (Fig. 16.)
13. Reniform, kidney-shaped. (Fig. 15.)

SPECIAL MORPHOLOGY

Leaf Classification—Continued

D. Leaves Classified as to Apex

1. Acute, shaped like an acute angle but not attenuated. (Fig. 17.)
2. Acuminate, shaped like an acute angle and attenuated. (Fig. 18.)
3. Obtuse, blunt or rounded at the end. (Fig. 19.)

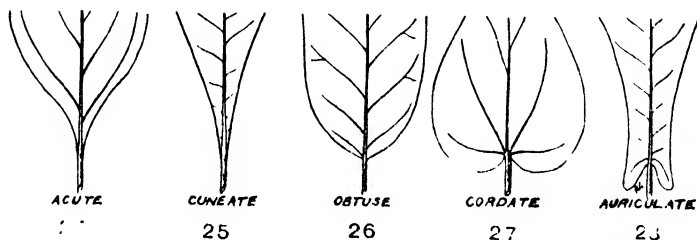


LEAF APEXES

4. Truncate, abruptly terminated as though cut off transversely. (Fig. 20.)
5. Emarginate, with a shallow notch. (Fig. 21.)
6. Obcordate, heart-shaped at the apex.
7. Mucronate, tipped with a mucro; abruptly tipped with a point. (Fig. 22.)
8. Cuspidate, tipped with a sharp, rigid point. (Fig. 23.)

E. Leaves Classified as to Base

1. Acute, shaped like an acute angle, but not attenuated. (Fig. 24.)
2. Cuneate, shaped like a wedge; broad above and tapering evenly to an acute base. (Fig. 25.)
3. Obtuse, blunt or rounded. (Fig. 26.)
4. Cordate, rounded and with broad rounded sinus. (Fig. 27.)



LEAF BASES

TREES OF NORTHEASTERN UNITED STATES

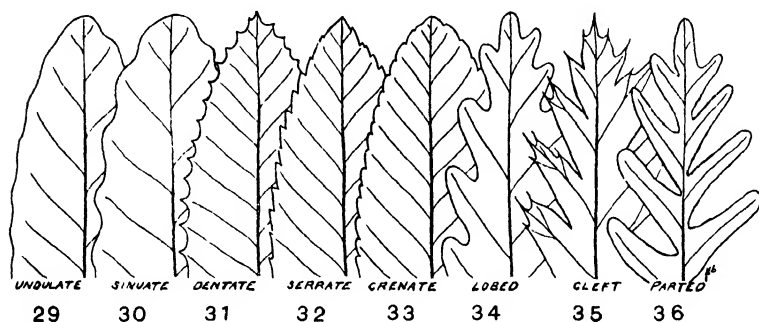
Leaf Classification—Continued

E. Leaves Classified as to Base—Concluded

5. Auriculate, with ear-like appendages at the base. (Fig. 28.)

F. Leaves Classified as to Margin

1. Entire, said of a margin without teeth or indentation.
2. Undulate (or repand), shallowly wavy. (Fig. 29.)



LEAF MARGINS

3. Sinuate, strongly wavy. (Fig. 30.)
4. Dentate, toothed, generally with the teeth projected outward. (Fig. 31.)
5. Serrate, with sharp teeth projecting forward. (Fig. 32.)
6. Crenate, dentate or serrate with rounded teeth. (Fig. 33.)
7. Lobed, divided into lobes by sinuses which extend not more than half way to the midrib, either the sinuses or lobes rounded. (Fig. 34.)
8. Cleft, divided into lobes by sinuses which extend half way or more to the midrib, either the sinuses or lobes narrow or acute. (Fig. 35.)
9. Parted, divided by sinuses which extend nearly to the midrib. (Fig. 36.)

G. Leaves Classified as to Venation

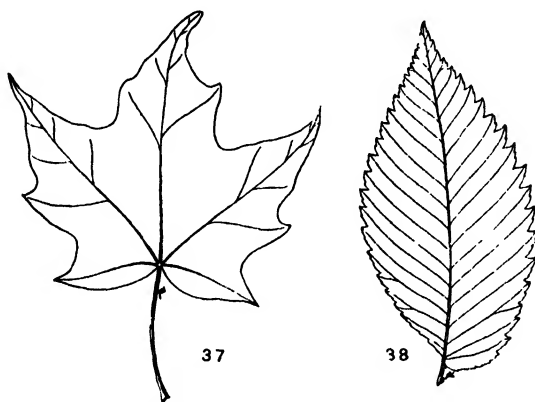
1. As to the arrangement of veins.
 - a. Pinnately veined, veins branching laterally from a strong longitudinal median vein, the midrib. (Fig. 38.)
 - b. Palmately veined, primary veins radiating from the apex of the petiole. (Fig. 37.)
2. As to direction of veins with reference to each other.
 - a. Netted, anastomosing to form a network or reticulum.

SPECIAL MORPHOLOGY

Leaf Classification—Continued

G. Leaves Classified as to Venation—Continued

b. Parallel, parallel and without apparent reticulum.



PALMATE AND PINNATE VENATIONS

INFLORESCENCES

The flowering part of a plant, especially the disposition of flowers on a plant, is known as the inflorescence. Inflorescences have received distinctive names which indicate the various sorts, but all are reducible to two main types, the indeterminate and the determinate, which occasionally intergrade to form a mixed inflorescence. Inflorescences may be classified as follows:

A. Indeterminate inflorescence. Axis of inflorescence terminated by a growing point which may prolong the floral axis indefinitely. Flowers from axillary buds.

1. Solitary. Said of flowers when they appear solitary in the axils of normal foliage leaves.
2. Clustered. Said of flowers when they are aggregated in groups. Foliage leaves are reduced to bracts or disappear altogether.

a. Simple clusters. Secondary axis terminated by a flower.

a¹ Spike. Flowers all sessile along the main axis. (Fig. 39.)

b¹ Catkin or ament. A flexuous, scaly spike. (Fig. 40.)

c¹ Raceme. Flowers all on pedicels which are shorter than the main axis. (Fig. 42.)

TREES OF NORTHEASTERN UNITED STATES

Inflorescences—Continued

Indeterminate inflorescences—Continued

Simple clusters—Continued

d¹ Umbel. Flowers all on nearly equal pedicels which spring from a common point like the ribs of an umbrella. (Fig. 44.)

e¹ Head. Flowers all sessile or nearly sessile and aggregated into a dense cluster on a receptacle or short axis. (Fig. 41.)

b. Compound Clusters. Secondary axis bearing several flowers arranged according to a definite plan.

a¹ Compound spike. Twice spikately compound.

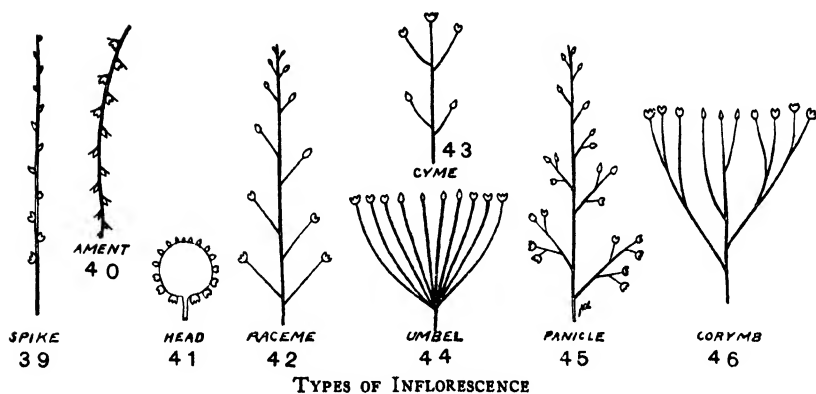
b¹ Compound raceme. Twice racemously compound.

c¹ Compound umbel. Twice umbellately compound.

c. Irregular clusters.

a¹ Panicle. A racemose flower-cluster in which some of the secondary clusters bear several irregularly disposed pedicelled flowers. (Fig. 45.)

b¹ Corymb. A flat-topped flower-cluster of the racemose type, with pedicels arising at different points along the main axis. (Fig. 46.)



TYPES OF INFLORESCENCE

B. Determinate inflorescence. Axis of inflorescence terminated by a flower which prevents further elongation of the primary axis. Represented by but one type with various modifications, the cyme. (Fig. 43.)

C. Mixed inflorescence. Said of an inflorescence in which both indeterminate and determinate types of branching are found; primary branching of one type, secondary branching of another type; rare in trees.

SPECIAL MORPHOLOGY

FLOWERS

General

Flowers are structures characteristic of the Spermatophytes or seed plants and bear stamens and ovules or immature seeds. In Gymnosperms these ovules are not enclosed in an ovary but are borne naked or in the axils of cone scales, and the flowers are devoid of perianth, while in the Angiosperms an ovary is always present and may be accompanied by a more or less showy perianth. The function of flowers is that of seed production and the various floral parts, included under the terms perianth and essential organs, are to be considered as modified leaves. The parts of a typical flower are as follows (see Fig. 47):

Floral Parts

- A. Pedicel or peduncle. Stalk of flower.
- B. Receptacle. End of peduncle bearing the remaining parts, usually somewhat enlarged.
- C. Perianth. The outer sets of modified leaves composing the non-essential part of the flower.
 - 1. Calyx. The outer set, consisting of sepals, usually green in color.
 - 2. Corolla. The inner set, consisting of petals, usually showy in color.
- D. Essential organs. Stamens and pistil.
 - 1. Androecium. The outer set of essential organs, the stamens, each consisting of an anther or pollen-bearing portion, borne on a stalk or filament.
 - 2. Gynoecium. The inner set of essential organs, the carpels, which unite to form a pistil. A pistil consists of (1) an enlarged basal part bearing ovules, (2) a slender stalk above, the style,* and (3) a terminal portion, receptive to pollen, the stigma.

Pollination versus fertilization

The higher plants, like the higher animals, exhibit sexuality which insures the continuance of a vigorous race. Early systematists believed the stamens and pistils of flowers to be male and female organs, but modern science has dissipated this belief. Stamens and ovules are rather the "bearers of sexual elements." The pollen grains which are loosed in immense numbers from the anther sacs of the stamens bear nuclei which

* Style may or may not be present.

TREES OF NORTHEASTERN UNITED STATES

have within them the inherent features of the male strain, while in the interior of the ovule, other nuclei are borne which are female nuclei. The transfer of pollen from the stamens to the vicinity of the ovules (stigma of angiosperms) is known as pollination and is brought about by various agents such as wind, insects, birds, and water. Subsequently the pollen grains germinate and form a tube which eventually permits of the union of the sex nuclei. Between pollination and fertilization only a few hours may intervene in some instances while in other cases it may be months before fertilization results.

Cross pollination, that is, the transference of pollen from one flower to the vicinity of the ovules of another, is desirable, and nature has devised many floral modifications to bring this about. Many plants exhibit diclinism, that is, imperfect flowers which may be monoecious, dioecious, or polygamous, and rely on wind or insects for pollination. Wind pollinated plants are usually characterized by abundant pollen which is often shed in advance of the leaves, inconspicuous flowers, expanded or feathery stigmas, and occasionally by explosive mechanisms in the stamens which catapult the pollen. Flowers which are insect pollinated are usually bright colored or possess nectar-glands which excrete saccharine or mal-odorous substances attractive to insects.

Other plants (some of the maples), exhibit dichogamy and dimorphism as a device to insure cross pollination. In dichogamous forms the stamens of a flower reach maturity in advance of the pistil (proterandrous) or vice versa (proterogynous) and this insures the union of sexual nuclei from different flowers. Dimorphic flowers are insect pollinated and have the essential organs arranged differently and in such a manner that an insect on visiting the one flower is dusted with pollen which is rubbed off by the stigma of the next.

Variation in the flower.

In addition to the floral modifications which have been obviously devised to insure cross pollination, flowers exhibit a truly wonderful variation in form, size, and in the arrangement, suppression, or union of parts that is quite beyond belief. Botanists observed this long ago and have learned from experience that the variation in the flower best indicates the natural affinities of flowering plants. Plants with comparable floral structures are related to each other. Flowers may be classified according to these variations as follows:

A. Suppression and symmetry of parts.

1. Perfect. With stamens and pistils(essential organs)present.

SPECIAL MORPHOLOGY

Variation in the flower—Continued

Suppression and symmetry of parts—Continued

2. Imperfect. With stamens or pistils only in some flowers or both in separate flowers.
 - a. Monoecious. With staminate and pistillate flowers on the same plant.
 - b. Dioecious. With staminate and pistillate flowers on separate plants.
 - c. Polygamous. With perfect and imperfect flowers on the same plant.
 - a¹ Polygamo-monoecious. With perfect and both sorts of imperfect flowers on the same plant.
 - b¹ Polygamo-dioecious. With perfect and staminate flowers on one plant and perfect and pistillate on another.
3. Complete. With all four sets of floral organs present.
4. Incomplete. With one or more sets of floral organs lacking.
5. Regular. With the individuals of each set similar in form and size.
6. Irregular. With the individuals of some sets varying in form or size from the others.

B. Position of parts.

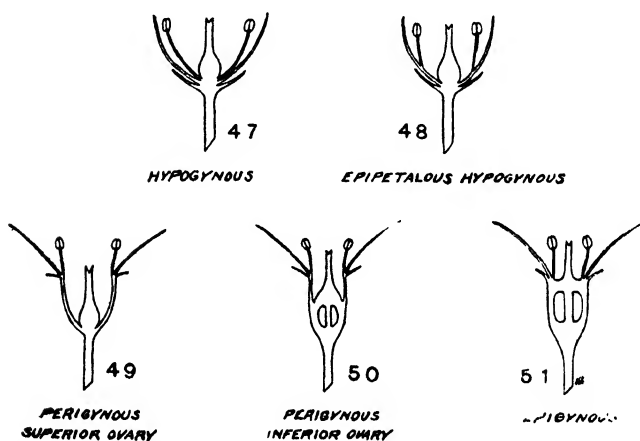
1. With reference to insertion on the receptacle.
 - a. Spiral. With floral organs spirally arranged.
 - b. Cyclic. With the parts of each set all inserted on the receptacle at the same height.
2. With reference to each other.
 - a. Flower hypogynous. With the three outer (lower) sets inserted below the ovary.
 - a¹ Strictly hypogynous. With the three outer (lower) sets inserted separately below the ovary. (Fig. 47.)
 - b¹ Epipetalous hypogynous. With the stamens inserted on the corolla, otherwise as above. (Fig. 49.)
 - b. Flower perigynous. With the calyx inserted below the ovary and the corolla and stamens inserted on the calyx.

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Variation in the flower—Continued

Flower perigynous—Continued

- a¹ Perigynous with superior ovary. Calyx free from the ovary, corolla and stamens inserted on calyx. (Fig. 49.)
- b¹ Perigynous with inferior ovary. Calyx adnate to the ovary, corolla and stamens inserted on calyx tube above the ovary. (Fig. 50.)
- c. Flower epigynous. With the parts apparently inserted on the summit of the ovary. (Fig. 51.)



TYPES OF FLOWERS

C. Union of parts.

1. Polypetalous, polysepalous. With the petals distinct; with the sepals distinct.
2. Gamopetalous, gamosepalous. With the petals united; with the sepals united.
3. Monadelphous stamens. With the stamens united by their filaments into one set.
4. Diadelphous stamens. With the stamens united by their filaments in two sets.
5. Syngenesious stamens. With the stamens united by their anthers into one structure, the filaments free.

D. Form of corolla.

1. Rotate. Wheel-shaped with the limb spreading at right angles.

Variation in the flower—Concluded

D. Form of corolla—Continued

2. Salverform. Tubular with the limb spreading at right angles.
3. Campanulate. Bell-shaped.
4. Urceolate. Cylindrical or ovoid and contracted in the throat like a vase.
5. Funnel-form. Tubular, with gradually spreading border.
6. Papilionaceous. Similar to the corolla of the Sweet Pea, consisting of a standard, two lateral wings and a keel (two petals).

FRUIT

General

The seed-bearing portion of a seed plant is known as the fruit. In the Gymnosperms it is usually represented by a cone-like structure consisting of scales bearing seeds in their axils. (Fig. 54.) The fruit of Angiosperms is the ripened ovary with such structures as adhere closely to it. The classification of angiosperm fruits hinges on the proper interpretation of the structure of the pistil.

Criteria for the Interpretation of the Pistil

The upper (inner) cycle of modified leaves (carpels) which enter into the structure of a flower are designated by the collective term of gynoecium. A gynoecium may consist of but a single carpel or an aggregate of carpels. In the latter case the carpels may retain their individuality as separate simple pistils or they may cohere into a single structure, a compound pistil. A simple pistil consists of but a single carpel; a compound pistil is made up of two or more carpels. The following criteria may be used to separate simple and compound pistils:

1. Several styles or stigmas indicate a compound pistil of a like number of carpels. The reverse does not apply as several carpels may have completely cohered.

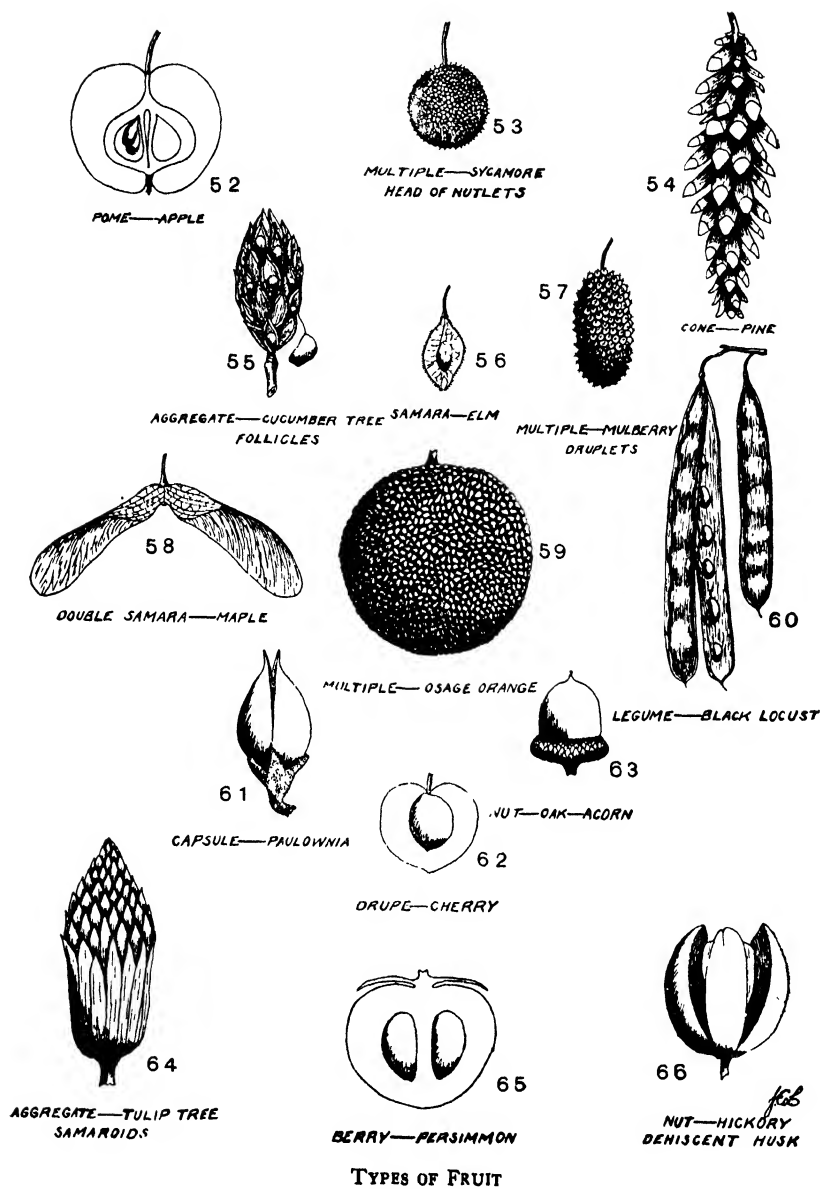
2. Several cells or loculi generally indicate a like number of carpels. The reverse does not apply as a compound ovary may consist of but a single cell.

3. Several parietal placentae generally indicate a like number of carpels.

4. Dehiscent dry fruits, resulting from more than one carpel, generally open by a like number of sutures.

The wall of a ripened ovary is known as the pericarp. Within the

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pericarp are one or more ovule-bearing chambers or loculi. A placenta denotes the line or surface within the ovary on which the ovules are borne. Placentae may be parietal (on the wall), basal, axile, or free central.

Classification of Angiosperm Tree-Fruits

A. Fruit classified as to the escape of the seed from the ovary

1. Dehiscent. Said of fruits which open at maturity to release the seed. Paulownia (Fig. 61).
2. Indehiscent. Said of fruits which do not open at maturity to release the seed. Elm (Fig. 56).

B. Fruit classified as to texture

1. Fleshy throughout or nearly so.
 - a. Soft-fleshy throughout except the seed. Berry (Persimmon, Fig. 65).
 - b. Fleshy throughout except the seed and the cartilagenous, leathery, or bony surfaces immediately surrounding the seed.
 - a¹ Exocarp indehiscent
 - a¹¹ Ovary producing the fruit superior. Drupe with several nutlets (Holly).
 - b¹¹ Ovary producing the fruit inferior. Pome (Apple, Fig. 52).
 - b¹ Exocarp dehiscent. Nut (Hickory, Fig. 66).
 2. Fleshy without, bony within. Drupe (Cherry, Fig. 62; Butternut).
 3. Dry
 - a. Indehiscent
 - a¹ Winged. Samara (Elm, Fig. 56; Maple, Fig. 58).
 - b¹ Unwinged
 - a¹¹ Rarely bony or woody
 - a¹¹¹ From a simple pistil, 1-seeded. Achene (Sycamore, Fig. 53).
 - b¹¹¹ From a compound pistil, generally more than 1-seeded. Indehiscent dry fruit.
 - b¹¹ Bony or woody. Nut (Oak, Fig. 63).
 - b. Dehiscent
 - a¹ From a simple pistil
 - a¹¹ Dehiscent by one suture. Follicle (Cucumber Tree, Fig. 55).

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Classification of Angiosperm Tree-Fruits—Continued

Fruit classified as to texture—Continued

Dehiscent—Continued

b¹¹ Dehiscent by two sutures. Legume (Black Locust, Fig. 60).

b¹ From a compound pistil. Capsule (Paulownia, Fig. 61).

C. Fruit classified as to composition

1. As to number of ovaries or flowers.

a. Former from one pistil. Simple fruit. (Cherry, Fig. 62).

b. Formed from several pistils in one flower. Aggregate fruit. (Tulip Tree, Fig. 64).

c. Formed from several flowers or an inflorescence. Multiple fruit. (Sycamore, Fig. 53; Mulberry, Fig. 57; Osage Orange, Fig. 59).

2. As to kind of parts.

a. Non-accessory. Consisting only of ovary or inferior ovary and adnate receptacle. (Apple, Fig. 52).

b. Accessory. Consisting of ovary and of other parts which are not organically connected with it. (Mulberry, Fig. 57; Osage Orange, Fig. 59).

WINTER CHARACTERS

General

With the approach of winter and the cessation of growth necessitated by it, biennial and perennial plants make definite provision to meet the rigors of the unfavorable season. Freezing temperatures have a drying effect on plant tissue in that the ice crystals start to form in the inter-cellular space (chinks) between cells rather than in the interior of the cell proper. Death may finally ensue through desiccation resulting from the removal of too much water from living cell contents as these crystals enlarge, rather than from the direct chilling action of low temperatures. Arborescent plants protect themselves from excessive transpiration during the winter months and resultant winter-killing as follows:

1. Leaf-fall.

2. Production of winter buds which are protected by bud-scales, gums, waxes, pubescence, etc.

3. Completion of growth in length and thickness, and "hardening" of the new tissue ere cold weather sets in.

4. Increase in the osmotic pressure of the cell sap, requiring lower temperatures to permit of the extraction of water from the cells.
5. Production of corky layers (periderm) on twigs and bole.

Growth in length versus Growth in Thickness

With the reawakening of growth in the spring, trees begin to grow in height and in thickness. Growth in thickness goes on throughout the whole length of the tree, including the roots, and has its inception in the activities of a growing layer (cambium) underlying the bark, the cells of which begin to divide and form new tissue. Growth in length is confined to the twig- and root-tips and results from buds which are either terminal or near the twig-apices. As these buds unfold the embryonic parts contained within elongate and assume their final size. The number of new nodes and internodes resulting from the opening of a bud varies largely with the species and vigor of the individual. In some cases all of the growth for the following season is found in the embryonic condition in the bud and, as the bud opens, merely enlarges to its permanent size. In the majority of cases, however, a number of embryonic nodes and internodes are included in the bud, capped by a growing point which continues to form new nodes for a time, or during the remainder of the summer. By far the majority of the trees of the North Temperate Zone exhibit definite growth, which ceases by July or early August after which no new growth in length takes place. In other instances the growth of the season may branch or longitudinal growth is indefinite and continues into the autumn until stopped by cold weather. In the latter case, the last formed parts, being soft and tender, are then usually winter-killed, resulting in a dead stub as in the case of the Staghorn Sumach.

New leaves are borne laterally at the nodes on the new growth, one or more as the case may be, and as early as June, the buds for the following season begin to form in their axils. By midsummer, on trees with definite growth, elongation of the new shoots has ceased, the buds have nearly attained their full winter size, and the remainder of the season is devoted to the ageing of the new tissues, preparatory to withstanding the rigors of winter.

Leaf Fall

As autumn approaches, trees with deciduous leaves make ready for leaf-fall while in persistent leaves, metabolism ceases or is greatly inhibited and certain changes occur preparatory to the winter season. Prior to leaf-fall, an absciss or fission layer of loose cells forms across the base of the petiole at its place of insertion on the twig. This in-

cludes all the tissues at that point aside from the vascular bundles leading from the stem into the petiole (leaf-traces). Subsequently a corky layer (periderm) forms under the absciss layer and Nature's preparations for leaf-fall are complete. With the advent of autumn rains or the formation on frosty nights of ice crystals between the cells of the absciss layer which exert a prying action, the leaf eventually snaps off at the base of the petiole, leaving a leaf-scar protected by a coating of periderm.

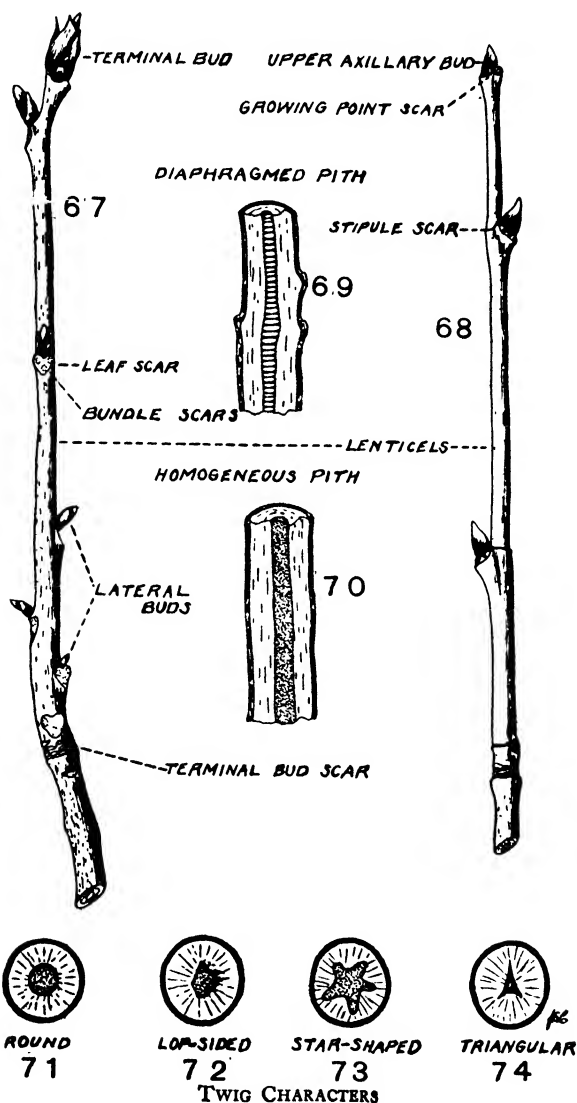
Winter Habit

The winter habit, especially of those species in which the foliage is deciduous, is of diagnostic value in identification and many species can be distinguished at some distance by the experienced observer by this character alone. Two general types of branching of the trunk are recognized which, however, undergo many minor variations, the excurrent or upright, and the deliquescent or spreading. In the former, the primary axis or bole is continued, without interruption, entirely through the crown, and is prolonged annually by a terminal leader which produces laterals at intervals, usually in whorls or false whorls which give a more or less storied appearance to the crown. This type of branching is characteristic of the coniferous trees and a few broad-leaf trees and is an important feature because long, straight, tapering trunks are produced which yield the maximum amount of lumber. The second type is characterized by a trunk which, sooner or later, divides to form several large limbs that give rise to a broad, spreading crown, as in most of the broad-leaved trees. While many valuable timber trees are included in this class, they produce less merchantable lumber in proportion on conversion because there is a greater wastage in the crown. Both types exhibit many variations which are in part specific and in part the result of environment. Certain species in age develop a high, flat-topped, spreading crown; in others the crown is oblong or ovate and extends to within a few feet of the ground. The crown may be dense or open, consist of upright, horizontal or pendent branches which are either straight and rigid in habit or lax or zigzag and variously contorted. Moreover, the crown shape varies with age and the density of the stand. Many trees in youth possess a narrow, conical crown which becomes oblong, ovate or ovoid as they attain maturity. Trees growing in the open usually have a larger crown development than those in dense stands and often develop into the so-called "wolf" trees. The best timber is generally produced in dense stands. In conclusion we may say that every tree in the winter condition has certain eccentricities which betray its identity to the trained observer who is familiar with them.

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Winter Twigs

The study of twigs in winter condition offers an entrancing subject to the student of trees and is an excellent training in the observation of details. The more important diagnostic features of winter twigs are buds, leaf-scars, bundle-scars, and color and character of the pith. (See Figs. 67-74.)



A. Winter Buds

A bud may be defined as an embryonic axis with its appendages. Many woody plants from the tropical rain forests where growth is practically continuous throughout the year, have buds which, as they are never truly dormant, are unprotected by typical bud scales such as are found in the arborescent plants of the temperate regions, but sheathed with embryonic leaves which are in various stages of unfolding. In such plants there is no demand for protective devices in that the climate is continually warm and humid, and low temperature, with its resulting drying action, is unknown. In regions where a winter season necessitates a period of dormancy, or where there are distinct seasonal wet and dry periods, resting buds, generally protected by overlapping scales, are characteristic structures of twigs and present many features which are of value in identification. Such buds may be classed as follows:

A. As to position.

1. Normal.

a. Terminal.* When terminal on the end of a twig. (Figs. 67 and 68.)

b. Axillary. When borne laterally on a twig in the axil of a leaf.

2. Adventitious. Abnormal buds produced under the stress of unusual conditions on any part of the root, stem, or leaf.

3. Accessory. Additional buds produced in addition to the normal bud.

a. Lateral accessory. Produced laterally, usually on either side of the normal bud.

b. Superposed. Produced above the normal bud.

4. Subpetiolar. Buds which burst through leaf-scars or are enclosed in the hollow base of a leaf-stalk and become visible only after leaf-fall. (Fig. 68.)

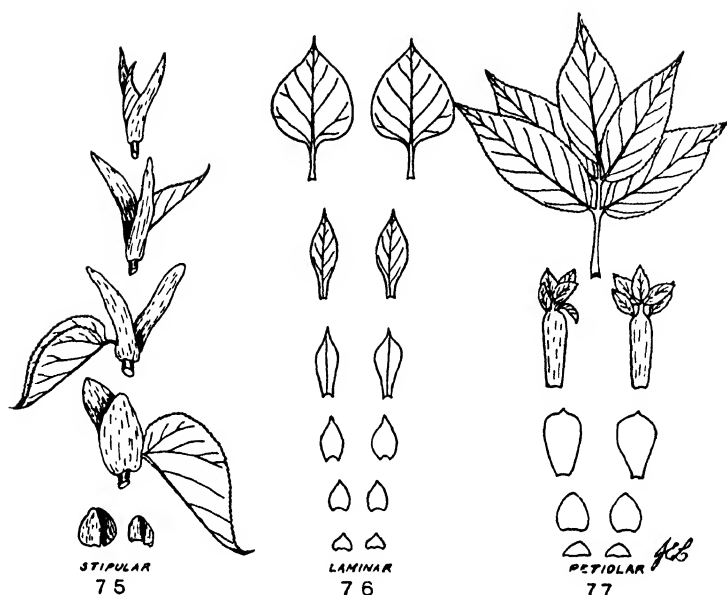
B. As to covering.

1. Scaly. Protected by scales which are valvate or overlap.

a. Laminar. When the bud-scales are modified leaf-blades (laminae). (Fig. 76.)

b. Petiolar. When the bud-scales are modified (flattened)

* Many woody plants are peculiar in developing pseudo-terminal buds. (Fig. 68.) Growth apparently continues into mid-summer until the available food supply is exhausted and the terminal growing point then withers and sloughs off, leaving a more or less circular scar with a ring of vascular tissue exposed. The last axillary bud then takes over the function of a terminal bud and continues the axis of growth. The result is a twig which is really a succession of branches developed by sympodial growth.



BUD DISSECTION SHOWING ORIGIN OF BUD SCALES

B. As to covering—Continued

leaf-stalks (petioles). (Fig. 77.)

c. Stipular. When the bud-scales are modified stipules. (Fig. 75.)

2. Naked. Devoid of scales; usually protected by hairs or
or down or by being sunk in the cortex.

The ideal time to study bud coverings is in the spring at the time of the inception of the new growth. Transition stages between typical leaf-parts and typical scales are often visible which indicate beyond question the origin of bud-scales.

It follows that stipular bud-scales are always found in pairs. Laminar and petiolar scales, inasmuch as they are leaf-parts proper, follow phyllotaxy. Plants with alternate leaves have alternate bud-scales of either of these types and the same applies to opposite-leaved plants. The number of bud-scales to a bud varies widely in different plants, but is fairly constant within the species.

C. As to contents.

1. Leaf-buds. Buds containing only the rudiments of leaves.
2. Flower-buds. Buds containing only the rudiments of
flowers or inflorescences.
3. Mixed buds. Buds containing the rudiments of both leaves
and flowers.

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D. As to dormancy.

1. Active. Buds which develop the spring following their formation or rarely the same season they are formed. Usually borne toward the top of the growth of the season.
2. Dormant. Buds which remain dormant except under the stress of exceptional conditions such as defoliation. Usually borne near the base of the growth of the season.

B. *Leaf-scars and Stipule-scars*

Leaf-scars are the scars on twigs which result from leaf-fall and of necessity have the same arrangement as leaves (Fig. 67). As pointed out in previous paragraphs, the fall of leaves in deciduous species is a normal physiological process for which Nature makes preparation some days in advance. Leaf-scars vary greatly in contour, size, and elevation above the surface of the twig and are important features in twig identification. They range in shape from narrowly V-shaped, linear, or lunate to semicircular, cordate and elliptical. The narrow forms may extend nearly or quite around the twig while the broad forms are usually confined wholly to one side. The size varies greatly in different kinds of trees. Trees with stout twigs, as *Ailanthus*, are usually characterized by large leaf-scars, while in other forms with slender twigs like some of the cherries, they are so small that the details of structure cannot be seen without a hand lens. Where leaf-scars are elevated above the surface of the twig owing to the elevation of the absciss layer, they are said to be decurrent on the twig, an expression which has been coined to indicate the somewhat fluted appearance of the twig immediately beneath the leaf-scar. Leaf-scars remain visible on twigs for a number of years but eventually slough off as new bark is formed beneath them by the enlarging branch.

On many twigs leaf-scars are accompanied by stipule-scars (Fig. 68) which are inserted laterally to the leaf-scars and assume various shapes. In other cases stipules are either wanting or speedily fugacious and leave no permanent traces on the stem. Where present, stipule-scars, like leaf-scars, vary in contour and may be triangular, semi-circular, etc. In trees like the Sycamore (Fig. 68) they extend around the stem obliquely and meet in a point on the back. Stipular thorns are features of the winter twigs of certain species and offer a ready means of identification.

C. *Vascular bundle-scars*

Vascular bundle-scars, generally termed "bundle-scars," are found included in the boundaries of leaf-, stipule-, and "growing point-scars."

(Figs. 67 and 68.) In stipule-scars they are generally so minute and indistinct as to be of no diagnostic value whatsoever. "Growing point-scars," that is, the scar resulting from the sloughing off of the growing point in woody plants of determinate growth, have vascular scars which are circular in outline with pith in the center. The grouping of bundle-scars within leaf-scars is of decided diagnostic value and constant within the species. The number of bundle-scars may vary from one to thirty or more. Many plants possess three prominent scars. In others the number is larger and they are irregularly scattered, arranged in three groups, in a single lunate line, in the form of an ellipse, etc., within the boundaries of the leaf-scar. Bundle-scars consist of vascular tissue (leaf-traces) which extended from the stem into the leaf and were ruptured and exposed to view at the time of leaf-abscission.

D. Color of Twigs

The color of twigs is very variable and caution must be employed in using this feature in identification. The colors range from nearly black through shades of green, red and brown, to gray or nearly white. Often the color of a portion of a twig depends upon its exposure. For example, in Basswood the upper part of the twig which is exposed to direct insolation is of a decided reddish cast, while the bark of the lower side is generally olive-green. Subsequently all twigs usually darken with age and eventually assume the hues of the mature bark. Some twigs are dull, others are lustrous or glaucous, that is, provided with a waxy bloom which rubs off. Many are smooth while others are granular, scabrous, or develop corky excrescences or wings, the function of which is uncertain. All grades of hairiness prevail from the pilose type with long, soft hairs, through hirsute, pubescent, and tomentose, and are characteristic features of certain species.

E. Taste and Odor of Twigs

Supplementing the color characteristics of twigs are those of taste and odor. Cherry twigs have the odor and taste of bitter almonds. The flavor of sassafras can be detected in the twigs of that species. Black and Yellow Birch contain an ethereal oil of wintergreen odor and taste. Hop-tree and Nannyberry possess twigs which give off a disagreeable odor when broken. The twigs of Silver Maple are distinguished from those of the Red Maple by their rank odor. In employing such characters for identification care must be taken not to include the twigs of Poison Sumach or Poison Oak as this would lead to unfortunate results.

F. Lenticels

An external feature of twigs that is of minor value in identification is the presence of lenticels (Figs. 67 and 68) which vary greatly in number, size, and color. Lenticels are organs of aeration which Nature has provided to insure a supply of oxygen to tissues underlying the corky periderm. These often contain chlorophyll which is active in the elaboration of plant food; in any case the living cells making up these tissues require oxygen for their maintenance. The initial covering of all twigs is known as the epidermis or outer skin. It is usually a single layer of cells, the outer walls of which are covered with a special waterproofing material known as cutin, and has, as its chief function, the protection from desiccation of the deeper lying tissues. In most woody plants the epidermis is comparatively short-lived and no provision is made for its expansion to accommodate the enlarging twig; it ruptures and sloughs off the second or third year. It is at this time that many twigs are covered with a gray, evanescent skin, the old epidermis, which is no longer a functional part of the tree but still clings to the twig. But prior to the rupturing of the epidermis, a new water-and air-proof layer, a number of cells in thickness, has arisen from the renewed division of cells underlying the epidermis. This is known as periderm and assumes the protective functions of the epidermis after the latter is ruptured. The cells of the periderm are strongly suberized, that is, corky, and are quite impervious to the passage of air or moisture, but here and there breaks in the continuity of the corky layer occur which consist of unsuberized, loosely attached cells, the so-called lenticels.

Lenticels make their appearance on the new growth during the first summer, soon after the unfolding of the new leaves. In some species they are relatively abundant and conspicuous structures and stand out clearly against the green background of the young stem, while in others they are sparse and relatively inconspicuous. At this stage they are usually punctate and orbicular in outline or somewhat . . . either vertically or longitudinally, and vary in color from white through shades of orange, brown and pink, to nearly black. Lenticels are generally uniformly distributed over the surface of the twig but in some cases there is a tendency toward aggregation below nodes or on the underside of twigs. As the twigs mature into branches and larger limbs, lenticels finally disappear owing to the exfoliation of the bark but in such ring-barked species as Birch and Cherry they may persist for many years as enlarged and horizontally elongated bodies which measure an inch or more in length.

G. Pith

With the exception of the tree ferns, the arborescent Monocotyledons, certain of the primitive Gymnosperms of dendroid habit, and scattered dicotyledonous species, trees are characterized by woody stems which possess a central pith or medulla and radial symmetry, and thicken by the addition of yearly increments which take the form of annual or seasonal rings as seen in cross section. The pith differs from the wood not merely in position but in the nature of the cells which constitute it. These are usually more or less globose or isogonal, often thin-walled and rather loosely aggregated, and reflect the light differently as seen in cross-sections of the twig. The function of pith is in doubt. In twigs or small branches it undoubtedly acts as a storage organ for reserve food during the winter but in older organs it apparently has no such function and remains as an obsolete tissue surrounded by heart wood.

The value of the pith in twig identification lies in its consistency, shape, and color. In the majority of woody plants it is homogeneous (Fig. 70) as seen in vertical section, without cross-partitions or interruptions of any kind. In other cases it may have disappeared entirely leaving a hollow stem, a condition which is unusual in trees but is occasional in shrubs as in certain Honeysuckles and the Snowberry. Black Walnut and Butternut have a diaphragmed or chambered pith (Fig. 69) which consists of many thin dissepiments spanning the pith cavity at brief intervals. Other trees such as the Hackberry and Tupelo possess a diaphragmed-stuffed pith in which the soft, homogeneous tissue which fills most of the pith cavity is interrupted by plates of denser tissue (stone cells).

The outline of the pith in cross-section varies in different kinds of trees, a character which may sometimes be used in their identification. Oaks, Chestnut, and Aspens are characterized by a star-shaped or 5-angled pith (Fig. 73), while the medulla is 3-angled in Alder (Fig. 74), features related respectively to $2/5$ ths and $1/3$ rd phyllotaxies. In many species such as the Elms and the Magnolias the outline is circular (Fig. 71), or it may be somewhat lopsided as in Basswood. (Fig. 72.) The size and color of the pith, especially in stout branches, may be conspicuous twig features. *Ailanthus* and Kentucky Coffee Tree both have stout twigs with a conspicuous medulla, but in the first case it is ochraceous, while that of the Kentucky Coffee Tree is salmon-pink. In different woody plants the color varies from white to pale or dark brown, with shades of pink, red or pale green as the exception, rather than the rule.

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H. *Bark*

The most important feature in the identification of standing trees in winter is the bark, though one of the most difficult to describe. Bark characteristics can best be taught by the visual method, by actual studies in the field supplemented by photographs and lantern slides.

In the preceding pages mention was made of the fact that the epidermis, as found in twigs, rarely functions for more than one year, but is soon replaced by a corky layer or periderm which takes over the protective function. The first layer of periderm is usually superficial in origin and has its inception in the layer of cortex immediately underlying the epidermis. It continues to function for a long period, often for 20-40 years, provision being made for the increase in girth through the addition of new layers from the dividing cells underneath and the imperceptible sloughing off of cell particles from without. Sooner or later deep cork formation begins and is immediately evinced by a roughening of the bark due to the desiccation and death of deeper-lying tissues. Deep cork formation may result from new periderms concentric with the first and give rise to ringed bark, as in Cherry and Birch, but in the majority of cases the new corky layers are in the form of arcs which encroach into the living tissues for varying distances. The thickness of bark varies greatly between species and individuals and depends largely on such factors as (1) the rapidity of formation, (2) time of the beginning of exfoliation, and (3) the rate of exfoliation. Beech, *Platanus* and Osage Orange are thin barked; in most of the Oaks and in Black Locust the bark is thick. It is due to the many minor variations in the time and manner of deep cork formation, the time of exfoliation, as well as the organic content of the tissues concerned that trees have bark characteristic of the species.

Chestnut Oak and Black Locust may be cited as possessing very rough bark, with deep longitudinal fissures. In other species the longitudinal fissures are comparatively shallow and are separated by acute or flat-topped, anastomosing ridges, as in Ash or Butternut. In the shell-barked species of Hickory the bark exfoliates in broad plates; in Hornbeam, in contrast, it is finely shreddy. Beech and Blue Beech are characterized by a smooth bark which fails to become rough, even with age. The bark of some of the Cherries and Birches is comparatively smooth and marked with prominent horizontal lenticels. Dogwood, Persimmon, and Black Gum exhibit the so-called alligator bark, the vertical ridges being interrupted by horizontal fissures which give the appearance of alligator skin. Hackberry is rough-barked and in addition, often has gnarly excrescences. In many cases it is difficult to put into

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words the distinctions which characterize the bark of various species though they may be readily distinguished in the field.

The color of bark is extremely variable, both between species and under different conditions of age, height, or location in the same species. In many cases these variations between individuals are puzzling to the novice and require a knowledge of the range of variation to decipher species. The prevailing colors are gray, brown, or black, but reddish and white bark are features of certain trees. In general the mature bark is darker than that of the branches and limbs, but exceptions to this occur. Moreover, the color of the inner bark is likewise characteristic of certain species; for example the inner bark of Black Oak (*Quercus velutina*) is yellow, while that of Hemlock is purplish red. Butternut has a yellow inner bark from which a yellow dye can be obtained. The bark of many species is a source of valuable forest products such as tannin, paper and rope fibers, dyes and cork.

LEAF KEY TO THE SPECIES

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| 2. Leaves $\frac{1}{2}$ of an inch or more in width..... | 20 |
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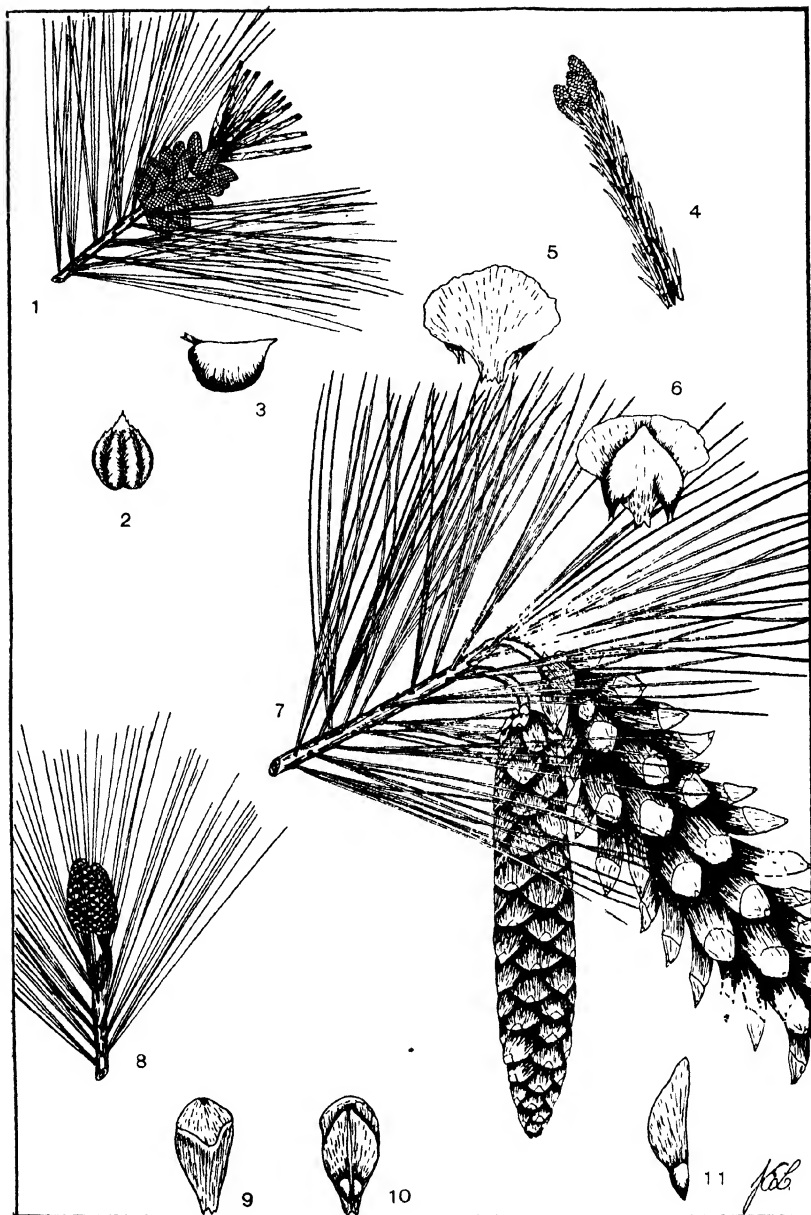
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**PLATES WITH LEGENDS AND TABULATED
DESCRIPTIVE INFORMATION**



White Pine, Northern White Pine, Eastern White Pine

Pinus strobus L.

1. A branch with staminate flowers $\times \frac{1}{2}$
2. A stamen, front view $\times 5$
3. A stamen, lateral view $\times 5$
4. A branch with ovulate flowers $\times \frac{1}{2}$
5. Cover-scale, lower side $\times 10$
6. Ovuliferous and cover-scales, upper side, showing ovules $\times 10$
7. A fruiting branch, showing mature cones, second year $\times \frac{1}{2}$
8. A fruiting branch, showing cones, first year $\times \frac{1}{2}$
9. Scale from mature cone, lower side $\times \frac{3}{4}$
10. Scale from mature cone, upper side, showing seeds $\times \frac{3}{4}$
11. Winged seed $\times \frac{3}{4}$

PINACEAE

Pinus strobus L.

White Pine, Northern White Pine, Eastern White Pine

Habit—The tallest conifer of northeastern United States, rarely at maturity attaining a height of 220 feet, usually 80 to 110 feet in height, with a trunk diameter of 3–4 feet. Trees growing in dense stands have small crowns with holes with little taper and free of branches for a long distance above the ground. In the open the crown is large and broadly conical; the bole is often forked, tapers abruptly, and bears whorls of branches (usually in fives) which persist nearly to the ground.

Leaves—Borne in fascicles of 5, needle-shaped, 3-sided, soft and flexible, bluish green, 3–5 inches long. New leaves at first surrounded by a deciduous sheath, attaining full size during August, and persisting through the second, rarely to the third season.

Flowers—Appearing in late May or early June, monoecious, borne in cones. Staminate cones clustered at the base of the growth of the season, about $\frac{1}{3}$ of an inch long, oval and yellow at maturity. Ovulate cones solitary or in small groups near the top of the growth of the season, oblong-cylindric, about $\frac{1}{2}$ of an inch in length, stalked, upright, pinkish purple at pollination.

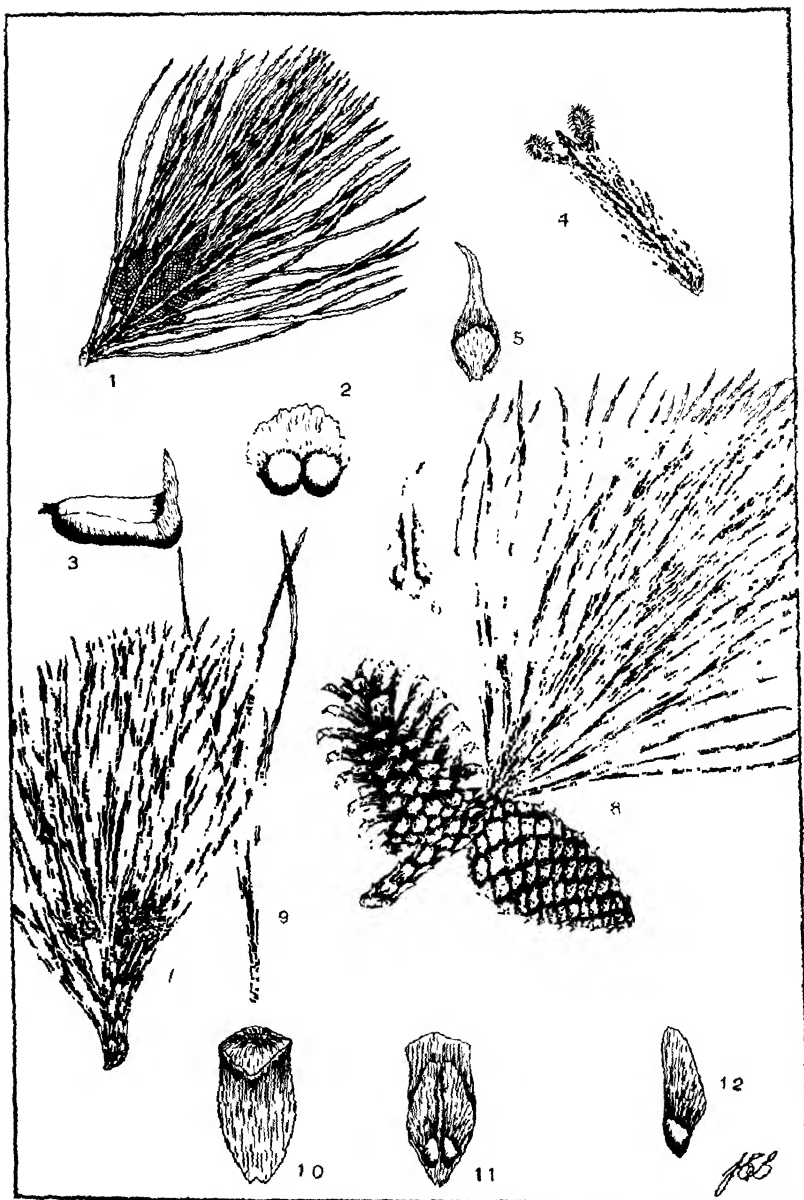
Fruit—A cylindrical green cone, 4 to 8 inches long, long-stalked and pendent, attaining full size during July of the second year, turning brown and opening in the autumn. Opened cones fall during the winter and following spring. Cone-scales thin, but slightly thickened at the apex, unarmed. Seeds reddish brown, winged, about $\frac{1}{4}$ of an inch long.

Winter characters—Branchlets slender, at first green and coated with rusty tomentum, later smooth and light orange-brown and roughened by the fascicle-scars. Buds $\frac{1}{4}$ – $\frac{1}{2}$ of an inch in length, ovate-oblong, acuminate, with many long-pointed and overlapping scales. Mature bark dark gray, thick, divided by shallow fissures into broad, continuous ridges.

Habitat—Prefers rich, moist, well-drained soils, but thrives on sandy and gravelly sites. Found in a wide range of habitats. Forms nearly pure stands in many localities; in others mixed with other conifers or forming a sparse upper story over mixed hardwoods.

Range—Newfoundland through southern Quebec to southern Manitoba, south along the coast to Maryland, thence in the Alleghenies to northern Georgia, in the Middle West south through northern and eastern Minnesota, eastern Iowa, and northern Indiana and Ohio.

Uses—The most important timber tree of the northeastern States. Often badly damaged or killed by the White Pine Blister Rust (*Cronartium ribicola*), a fungus which grows in the inner bark. Deformed trees frequently result from the attacks of the White Pine Weevil (*Pissodes strobi*) which kills the terminal leader. Wood light, soft, weak, resinous, straight-grained, easily worked, light brown, occasionally with a tinge of red, with thin, whitish sapwood. Used for a great variety of purposes where a soft, easily-worked wood is desired. White Pine is of rapid growth, responds readily to propagation, and is widely used in reforestation. Planted both here and abroad (Weymouth Pine) for shade and ornament.



Pitch Pine

Pinus rigida Mill.

1. A branch with staminate flowers $\times \frac{1}{2}$
2. A stamen, front view $\times 5$
3. A stamen, lateral view $\times 5$
4. A branch with ovulate flowers $\times \frac{1}{2}$
5. Cover- and ovuliferous scales, lower side $\times 15$
6. Ovuliferous scale, upper side, showing ovules $\times 15$
7. A fruiting branch showing cones, first year $\times \frac{1}{2}$
8. A fruiting branch showing mature cones, second year $\times \frac{1}{2}$
9. A fascicle showing needles $\times \frac{1}{2}$
10. Scale from mature cone, lower side $\times \frac{1}{2}$
11. Scale from mature cone, upper side, showing seeds $\times \frac{1}{2}$
12. Winged seed $\times \frac{1}{2}$

PINACEAE
***Pinus rigida* Mill.**

Pitch Pine*

Habit—A tree occasionally 70–80 feet in height, usually 40–60 feet tall, with a trunk diameter of 2–3 feet. Crown in young trees narrowly pyramidal and open, the horizontal branches stout, rigid, produced in regular, rather distant whorls. In old trees the crown becomes irregular, thin and rounded, consisting of coarse, gnarled branches which are often pendulous at the tip and bear tufts of yellow-green foliage. Spring shoots multinodal, forming 2–3 whorls of branches in one season. Tap root present. Stump sprouts form where vigorous trees are felled.

Leaves—Borne in fascicles of 3, needle-shaped, sharply serrulate, stout, blunt-pointed, rigid, yellowish green, 3–5 inches long, divergent from a short sheath, falling during the second or third season.

Flowers—Appearing in May and early June, monoecious, borne in cones. Staminate cones clustered at the base of the growth of the season, about $\frac{3}{4}$ of an inch long, cylindrical, somewhat flexuous, yellow at maturity. Ovulate cones solitary or clustered, lateral near the top of the growth of the season, subglobose, about $\frac{1}{2}$ of an inch long, borne on short, stout stalks, upright and reddish green at pollination. Scales acuminate, divergent.

Fruit—An ovoid-conical or ovoid, prickly, green cone, 1 to $3\frac{1}{2}$ inches long, sessile or nearly so, usually at right angles to the branch, attaining full size during early autumn of the second year, opening tardily during the late fall and winter and remaining on the trees for a decade or more. Cone-scales thickened at the apex, armed with a short, rigid, recurved prickle. Seeds dark brown or dull black, winged, about $\frac{1}{4}$ of an inch long.

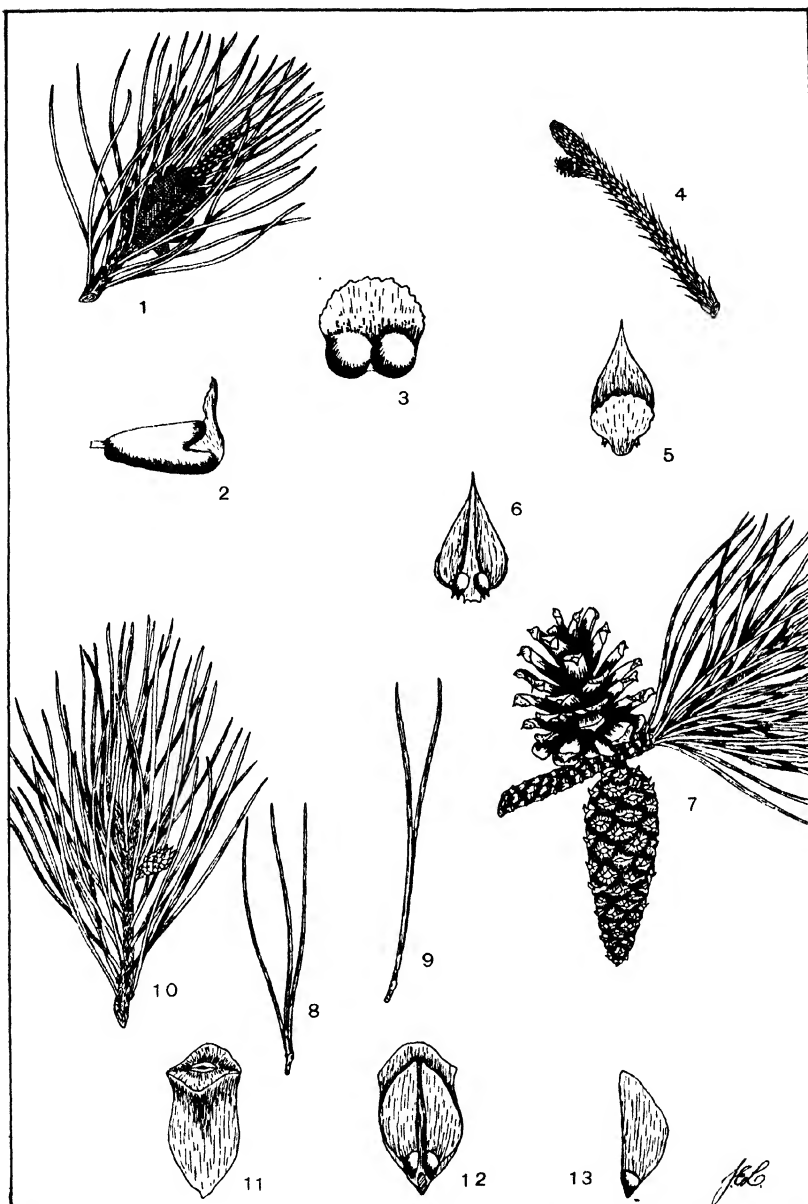
Winter characters—Branchlets stout, roughened by the persistent, decurrent leaf-bases of the scale-leaves which subtended the fascicles, at first dull orange, later dark grayish brown. Buds $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long, ovate or obovate-oblong, acute, with lanceolate, dark chestnut-brown scales, scarious and fringed at the margins. Mature bark dark reddish brown, thick, divided by deep furrows into broad, flat-topped ridges.

Habitat—Occurs on gravelly uplands and sandy plains, rarely on the edges of cold swamps. Thrives well on barren sandy sites. Common in the north on glacial soils. Frequently associated with Scrub Oak.

Range—New Brunswick through central Maine to the north shore of Lake Ontario, south through western New York, northwestern Pennsylvania, southeastern Ohio, eastern Kentucky, and eastern Tennessee.

Uses—Of less importance than White or Red Pine as a source of lumber. Wood light, soft, coarse-grained, brittle, light brown or red, with thick yellowish white sapwood. Occasionally converted into lumber. Of some value in reforestation because of its adaptability to poor soils and its fire-resisting qualities (thick, corky bark). Mature trees generally have a picturesque appearance.

*Pond Pine ranges from the vicinity of Cape May, New Jersey to Virginia and southward near the coast to Florida and central Alabama; while it has some of the characteristics of Loblolly Pine, *Pinus taeda* L., it is generally listed as *Pinus rigida* var. *serotina* Loud. It differs from Pitch Pine in possessing longer (6–8 inches), more flexible needles, and more rounded cones with weaker, deciduous prickles.



Short-leaved Pine, Yellow Pine

Pinus echinata Mill. [*Pinus mitis* Michx.]

1. A branch with staminate flowers x $\frac{1}{2}$
2. A stamen, lateral view x 10
3. A stamen, front view x 10
4. A branch with ovulate flowers x $\frac{1}{2}$
5. Cover- and ovuliferous scales, lower side x 8
6. Ovuliferous and cover-scales, upper side, showing ovules x 8
7. A fruiting branch showing mature cones, second year x $\frac{1}{2}$
8. A fascicle showing three needles x $\frac{1}{2}$
9. A fascicle showing two needles x $\frac{1}{2}$
10. A fruiting branch showing cones, first year x $\frac{1}{2}$
11. Scale from mature cone, lower side x 1
12. Scale from mature cone, upper side, showing seeds x 1
13. Winged seed x 1

PINACEAE

Pinus echinata Mill. [*Pinus mitis* Michx.]

Short-leaved Pine, Yellow Pine

Habit—A tree at maturity attaining a height of 80–100 feet, occasionally 120 feet, with a trunk diameter of 3–4 feet. Crown broad, pyramidal, truncate, consisting of slender, somewhat pendulous, very brittle branches. Spring shoots multinodal, forming 2–3 whorls of branches in one season. Trunk long, clean, somewhat tapering. Stumps of trees up to 10 years of age produce vigorous shoots which will mature into merchantable trees.

Leaves—Borne in fascicles of 2–3 (rarely 4), needle-shaped, closely serrulate, abruptly pointed, soft and flexible, dark bluish green, 3–5 inches long, persisting from two to five years.

Flowers—Appearing in April and May, monoecious, borne in cones. Staminate cones clustered at the base of the growth of the season, nearly sessile, about $\frac{3}{4}$ of an inch long, oblong-cylindrical, pale purple at maturity. Ovulate cones usually in pairs or clusters of three or four, rarely solitary, subterminal on the growth of the season, oblong to subglobose, about $\frac{1}{2}$ of an inch long, on stout ascending stalks, pale rose-colored at pollination.

Fruit—An ovoid, or oblong-conical, chestnut-brown cone, $1\frac{1}{2}$ – $2\frac{1}{2}$ inches long, subsessile, horizontal or pendent, attaining full size and maturity during the second autumn. Opened cones persist on the branches for several years. Cone-scales with slightly thickened ends, equipped with weak, straight or recurved, usually deciduous prickles.

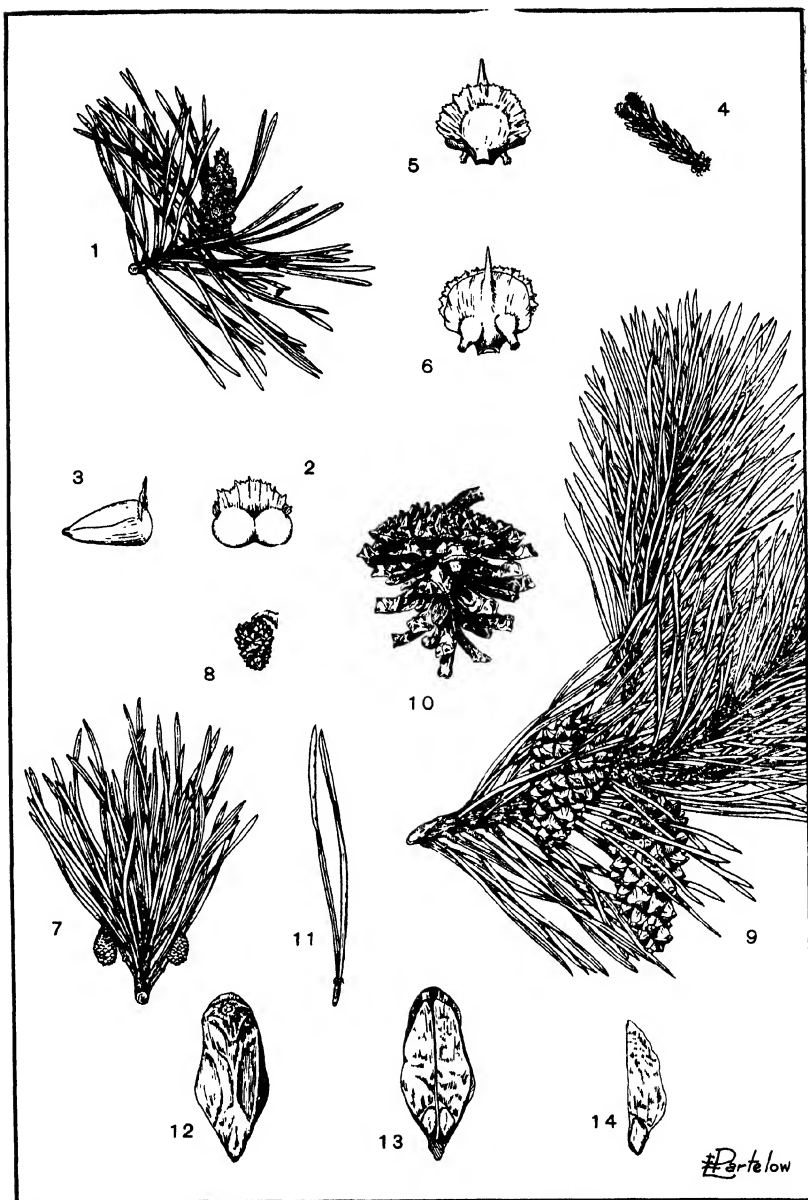
Winter characters—Branchlets stout, brittle, somewhat rough, at first pale green or violet and glaucous, later dark reddish brown and scaly. Buds $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, ovate, obtuse, with ovate-lanceolate, closely imbricated, chestnut-brown scales which are divided above the middle into matted filaments. Mature bark dark brown tinged with red, divided by fissures into irregular, scaly, angular plates.

Habitat—Occurs on a wide range of sites on plains, foothills, and tablelands. Thrives on poor clayey and sandy soils. Grows in pure stands or associated with oaks and other hardwoods.

Range—Staten Island, N. Y.,* through New Jersey, central Pennsylvania, extreme southern Ohio, Indiana, and Illinois, southern Missouri, extreme southeastern Kansas, southward to eastern Texas and in all the states east and south of this boundary.

Uses—An important timber species, ranking second in importance among the Southern Yellow Pines. Wood heavy, hard, strong, resinous, coarse-grained, variable in quality, orange or yellowish brown in color with pale white sapwood. Largely manufactured into lumber for a variety of purposes. Within its natural range valuable in reforestation because of the ease of self-generation.

*Reported as occurring at one time in the lower Hudson Valley.



Scots Pine

Pinus sylvestris L.

1. A branch with staminate flowers x $\frac{1}{2}$
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x $\frac{1}{2}$
5. Cover-scale and tip of ovuliferous scale, lower side x 10
6. Ovuliferous scale, upper side, showing ovules x 10
7. A fruiting branch showing cones, first year x $\frac{1}{2}$
8. A cone, first year x $\frac{1}{2}$
9. A fruiting branch showing mature cones x $\frac{1}{2}$
10. Mature cone after seed dispersal x $\frac{1}{2}$
11. A fascicle showing needles x $\frac{1}{2}$
12. Scale from mature cone, lower side x 1
13. Scale from mature cone, upper side, showing seeds x 1
14. Winged seed x 1

PINACEAE
***Pinus sylvestris* L.**

Scots Pine

Habit—A tree, usually with a height of 60—90 feet at maturity but under optimum conditions in Western Europe and the British Isles sometimes becoming 150 feet tall. Crown pyramidal when young, under forest conditions at length umbrella-like and borne on a tall unbranched bole. In the open the tree frequently retains its branches low down on the trunk for many years. A number of geographical varieties or races are recognized of which Var. **rigensis** Loud. is the most important silviculturally.

Leaves—Borne in fascicles of 2, needle-shaped, semi-cylindrical, stout, usually twisted, acute, serrulate, dull blue-green (especially on the flat upper surface), usually $1\frac{1}{2}$ —2 (rarely up to 4) inches long, generally falling at the end of the third year. Fascicle-sheath persistent.

Flowers—Appearing in May and June, monoecious, borne in cones. Staminate cones clustered at the base of the growth of the season, about $\frac{1}{4}$ th of an inch long, ovoid, yellow at maturity. Ovulate cones solitary or 2-several near the top of the growth of the season (sub-terminal), subglobose, about $\frac{1}{4}$ th of an inch long, upright, stalked, dark green or reddish at pollination.

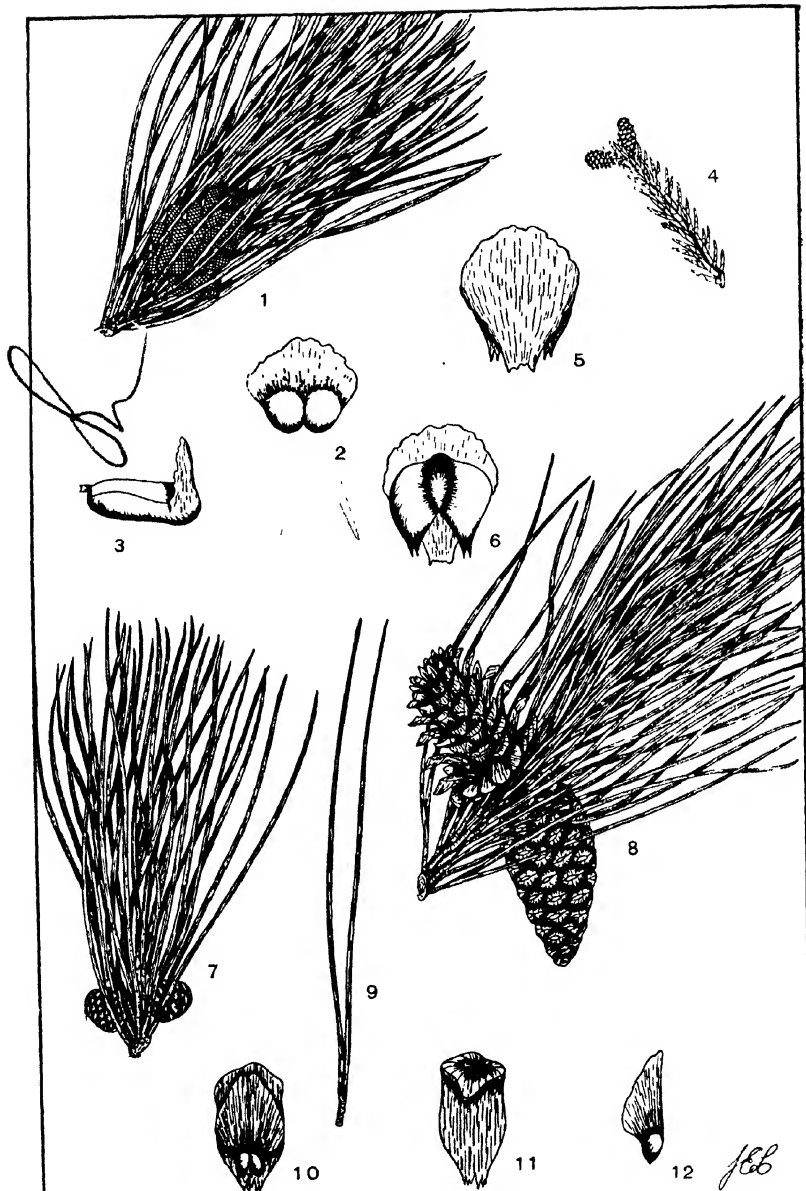
Fruit—An oblong-conical, dull tawny-yellow cone, 1—2 $\frac{1}{2}$ inches long, straight or sometimes curved, short-stalked, reflexed, attaining full size and turning brown the second autumn, occasionally opening and shedding a few seeds in the second autumn but usually remaining closed until after the appearance of the female flowers the following spring. Cone-scales thickened at the apex, with a minute prickle or its remnant. Seeds brown, winged, about $\frac{1}{4}$ th of an inch long.

Winter Characters—Branchlets medium thick, brittle, roughened by the persistent decurrent bases of the scale-leaves, at first pallid green, becoming dull grayish yellow as the season advances. Buds oblong-ovoid, brown, often resin coated, about $\frac{1}{4}$ of an inch long. Mature bark grayish brown, medium thick, marked with longitudinal and oblique fissures near the base of the tree, further up on the trunk and on the larger branches flaking off in thin papery orange-colored scales in a characteristic manner.

Habitat—Thrives best on well drained sites where the soil is deep and moist but also grows on dry sandy loams and the thin soils of rocky outcrops. Essentially a lowland species but in the Caucasus extending above 8000 feet as a stunted, mal-formed tree.

Range—Sparingly naturalized in the Northeast. Native to the Old World from Europe to Siberia and extending to the limit of coniferous forest at 70°N.

Uses—Extensively used in reforestation in eastern United States and adapted to varying soil and climatic conditions at least as far west as the Rocky Mountain region. Survives transplanting well, grows rapidly except under adverse conditions, and is quite free of fungal diseases and insect pests. Where stock is grown from seed, care should be taken to see that seed of the right 'variety' is obtained.



Red Pine, Norway Pine

Pinus resinosa Ait.

1. A branch with staminate flowers $\times \frac{1}{2}$
2. A stamen, front view $\times 5$
3. A stamen, lateral view $\times 5$
4. A branch with ovulate flowers $\times \frac{1}{2}$
5. Cover-scale, lower side $\times 15$
6. Ovuliferous and cover-scales, upper side, showing ovules $\times 15$
7. A fruiting branch showing cones, first year $\times \frac{1}{2}$
8. A fruiting branch showing mature cones, second year $\times \frac{1}{2}$
9. A fascicle showing needles $\times \frac{1}{2}$
10. Scale from mature cone, upper side, showing seeds $\times 1$
11. Scale from mature cone, lower side $\times 1$
12. Winged seed $\times 1\frac{1}{4}$

PINACEAE
***Pinus resinosa* Ait.**

Red Pine, Norway Pine

Habit—A tree, usually 50—80 feet in height, with a trunk diameter of 2—3 feet, occasionally 120 feet tall. Crown at first broadly pyramidal, with stout, thick-spreading branches which are more or less pendulous and clothe the bole to the ground, in age forming an open, round-topped head.

Leaves—Borne in fascicles of 2, needle-shaped, semi-cylindrical, rather slender, flexible, dark green and shining, 5—6 inches long, falling during the fourth and fifth season. Fascicle-sheaths persistent.

Flowers—Appearing in May and early in June, monoecious, borne in cones. Staminate cones in dense clusters at the base of the growth of the season, about $\frac{1}{2}$ of an inch long, oblong, dark purple at maturity. Ovulate cones solitary or in whorls of 2—3 near the top of the growth of the season, subglobose, about $\frac{1}{4}$ of an inch long, stalked, upright, scarlet at pollination.

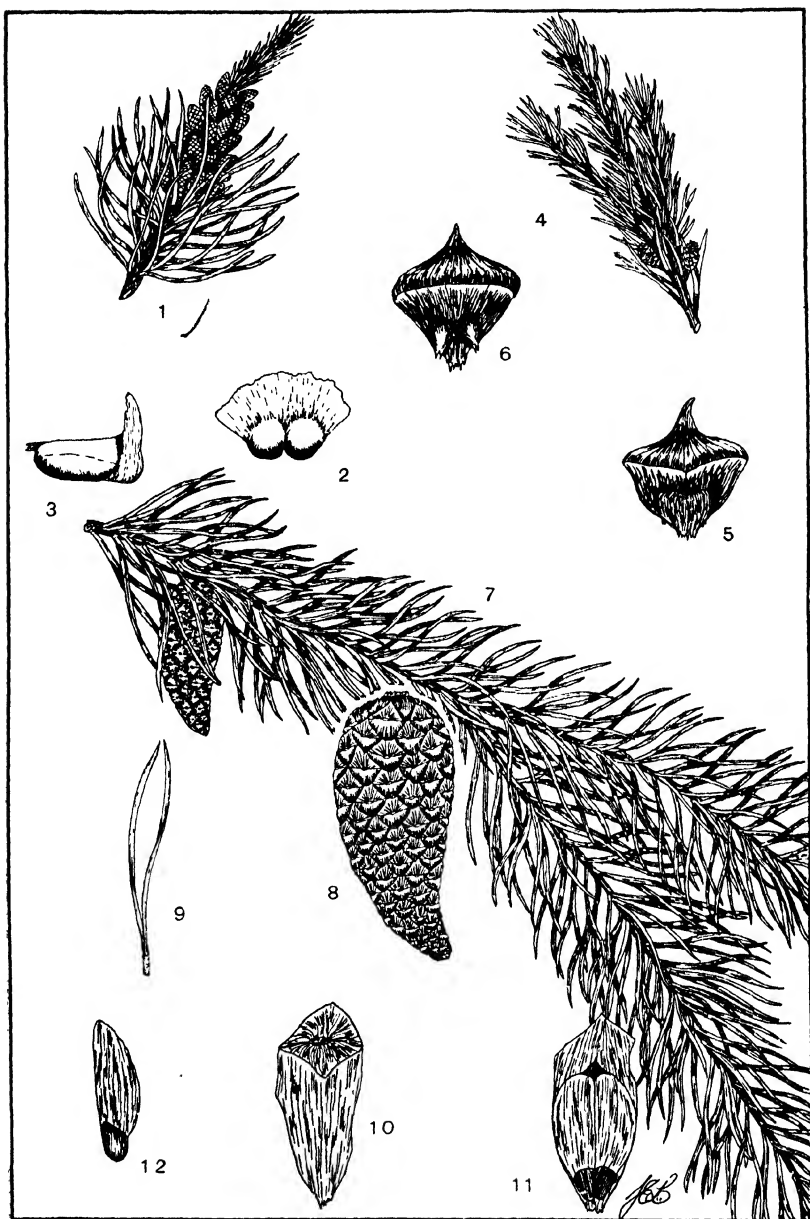
Fruit—An ovoid-conical, green cone, 2—2 $\frac{1}{4}$ inches long, sessile, horizontal, attaining full size during the second summer, turning light chestnut-brown and opening in the autumn. Opened cones persist on the branches until the following season. Cone-scales with slightly thickened and ridged end, unarmed. Seeds dark chestnut-brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Branchlets stout, roughened by the persistent bases of the leaf-buds, at first orange in color, when older, light reddish brown. Buds $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, ovate, acute, with lanceolate, loosely imbricated, chestnut-brown scales, white and fringed on the margins. Mature bark light reddish brown, thick, divided by shallow fissures into broad, flat ridges.

Habitat—Thrives on dry, gravelly ridges and sandy plains where poor soils are found. Rare on low, wet ground. Usually forms open groves of a few acres extent, scattered through forests of other species, but often found in mixture with other species.

Range—Southern New Brunswick west to extreme southeastern Manitoba, in the East south to eastern Massachusetts and thence along the mountains to northern Pennsylvania, in the West through northeastern Minnesota, northern and northeastern Wisconsin, southern Michigan and along the north shore of Lake Erie to western New York and Pennsylvania.

Uses—A timber species. Wood light, hard, close-grained, pale red with thin, yellowish white sapwood. Used for lumber in rough construction, for ties, mine props, etc. Utilized extensively in forest planting because of its rapid growth and hardness but not a good seeder, good seed crops occurring at intervals of 3—4 years.



Jack Pine, Gray Pine, Scrub Pine

Pinus banksiana Lamb. [*Pinus divaricata* (Ait.) Du Mont de Cours]

1. A branch with staminate flowers x $\frac{1}{2}$
2. A stamen, front view x 15
3. A stamen, lateral view x 15
4. A branch with ovulate flowers x $\frac{1}{2}$
5. Cover- and ovuliferous scales, lower side x 15
6. Ovuliferous scale, upper side, showing ovules x 15
7. A fruiting branch showing mature cone, second year x $\frac{1}{2}$
8. Mature cone x 1
9. A fascicle showing needles x $1\frac{1}{2}$
10. Scale from mature cone, lower side x $1\frac{1}{2}$
11. Scale from mature cone, upper side, showing seeds x $2\frac{1}{2}$
12. Winged seed x $2\frac{1}{2}$

PINACEAE

Pinus banksiana Lamb. [*Pinus divaricata* (Ait.) Du Mont de Cours]

Jack Pine, Gray Pine, Scrub Pine

Habit—Usually a small tree 15–40 feet in height, with a trunk diameter of 9 to 15 inches and a scrubby, stunted, irregular crown which often extends nearly to the ground. At its optimum range it becomes 80 feet in height, with a straight trunk free from branches for twenty or more feet. Gnarly, scraggly specimens are common on poor soils. Branches long, spreading, characteristically clothed with short needles and incurved cones. Spring shoots multinodal, forming 2–3 whorls of branches in one season. Stump sprouts sometimes form when young trees are cut.

Leaves—Borne in fascicles of 2, needle-shaped, semi-cylindrical, stout, stiff, generally curved and twisted, dark yellowish green, $\frac{3}{4}$ – $1\frac{1}{4}$ inches long, falling gradually during the second and third years. Fascicle-sheath short and persistent.

Flowers—Appearing in May and June, monoecious, borne in cones. Staminate cones in crowded clusters at the base of the growth of the season, about $\frac{1}{2}$ of an inch long, oblong, yellow at maturity. Ovulate cones in clusters of 2–4, borne laterally on the shoots of the season (often two clusters to a shoot), subglobose, about $\frac{1}{4}$ of an inch long, upright, stalked, dark purple at pollination.

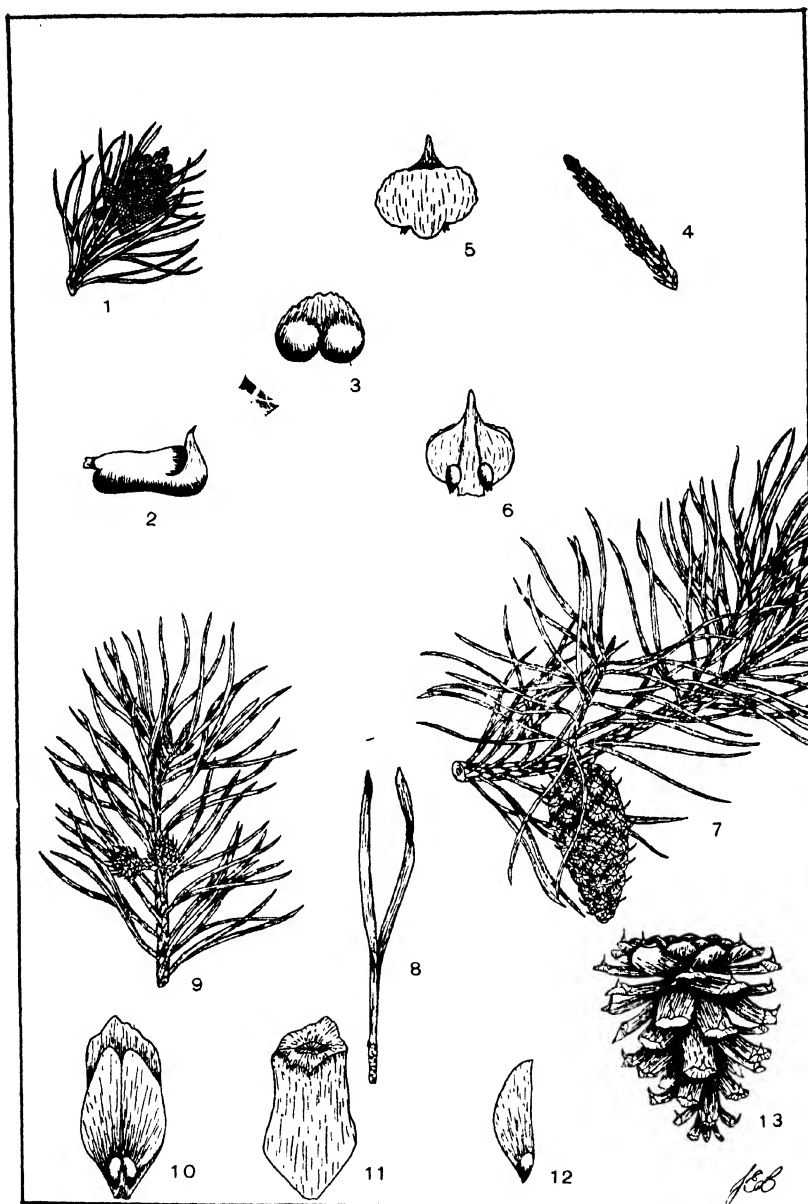
Fruits—An oblong-conical, dull purple or green cone, $1\frac{1}{2}$ –2 inches long, sessile, ascending and often strongly incurved, attaining full size the second autumn, turning light yellow and remaining closed for several years. Cones persist on the branches for a decade or more. Cone-scales thin, often irregularly developed, armed with a minute, incurved, often deciduous prickle. Seeds dark brownish black, winged, about $\frac{1}{8}$ th of an inch long.

Winter characters—Branchlets slender, roughened by the persistent, decurrent bases of the scale-leaves, at first pale yellowish green, at length becoming dark purplish brown. Buds $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, oblong-ovoid, blunt, with ovate-lanceolate, pale chestnut-brown scales with spreading tips. Mature bark dark brown slightly tinged with red, thin, irregularly divided into narrow, rounded, scaly ridges.

Habitat—Found on very dry, sterile, sandy soils and on rocky ridges, more rarely on lowlands and boggy plains. Often covers great tracts of barren lands and sand dunes, in pure stands or in mixture with other stunted trees.

Range—Nova Scotia through southern Quebec and north-central Ontario, thence northwestward to west-central MacKenzie, extending southward into northern New England and New York, the central portion of the Lower Peninsula of Michigan to the south shore of Lake Michigan in Illinois, thence northwestward through Wisconsin and northeastern Minnesota.

Uses—Of little importance as a timber tree. Wood knotty, light, soft, weak, close-grained, pale brown to orange in color with a thick white sapwood. Used for pulp in admixture with other woods, and for fuel. Occasionally manufactured into lumber, railroad ties, etc.



Virginia Pine, Scrub Pine, Jersey Pine

Pinus virginiana Mill. [*Pinus inops* Ait.]

1. A branch with staminate flowers x $\frac{1}{2}$
2. A stamen, lateral view x 10
3. A stamen, front view x 10
4. A branch with ovulate flowers x $\frac{1}{2}$
5. Cover-scale, lower side x 10
6. Ovuliferous scale, upper side, showing ovules x 10
7. A fruiting branch showing a mature cone, second year x $\frac{1}{2}$
8. A fascicle showing needles x 1
9. A fruiting branch showing cones, first year x $\frac{1}{2}$
10. Scale from mature cone, upper side, showing seeds x $\frac{3}{4}$
11. Scale from mature cone, lower side, x $\frac{3}{4}$
12. Winged seed x $\frac{1}{2}$
13. Mature cone, after seed dispersal x $\frac{1}{2}$

PINACEAE

Pinus virginiana Mill. [*Pinus inops* Ait.]

Virginia Pine, Scrub Pine, Jersey Pine

Habit—In the northern portion of its range, a small tree usually 30—40 feet in height, with a short trunk rarely more than 18 inches in diameter. Farther south and west it occasionally attains a height of 100 feet, with a trunk 2—3 feet in diameter. Crown in young trees pyramidal, reaching to the ground; in older trees open, flat-topped, pyramidal, with long horizontal or pendulous branches in remote whorls. Spring shoots multinodal, forming 2—3 whorls of branches in one season.

Leaves—Borne in fascicles of 2, needle-shaped, semi-cylindrical, rather stout, closely serrulate, acute, rigid, generally twisted and divergent, grayish green, $1\frac{1}{2}$ —3 inches long, persisting three or four years.

Flowers—Appearing in April and May, monoecious, borne in cones. Staminate cones in crowded clusters at the base of the growth of the season, about $\frac{1}{3}$ of an inch long, oblong, pale orange-brown at maturity. Ovulate cones solitary or paired near the middle of the growth of the season, subglobose, about $\frac{1}{3}$ of an inch long, long-pedunculate, pale green tinged with rose.

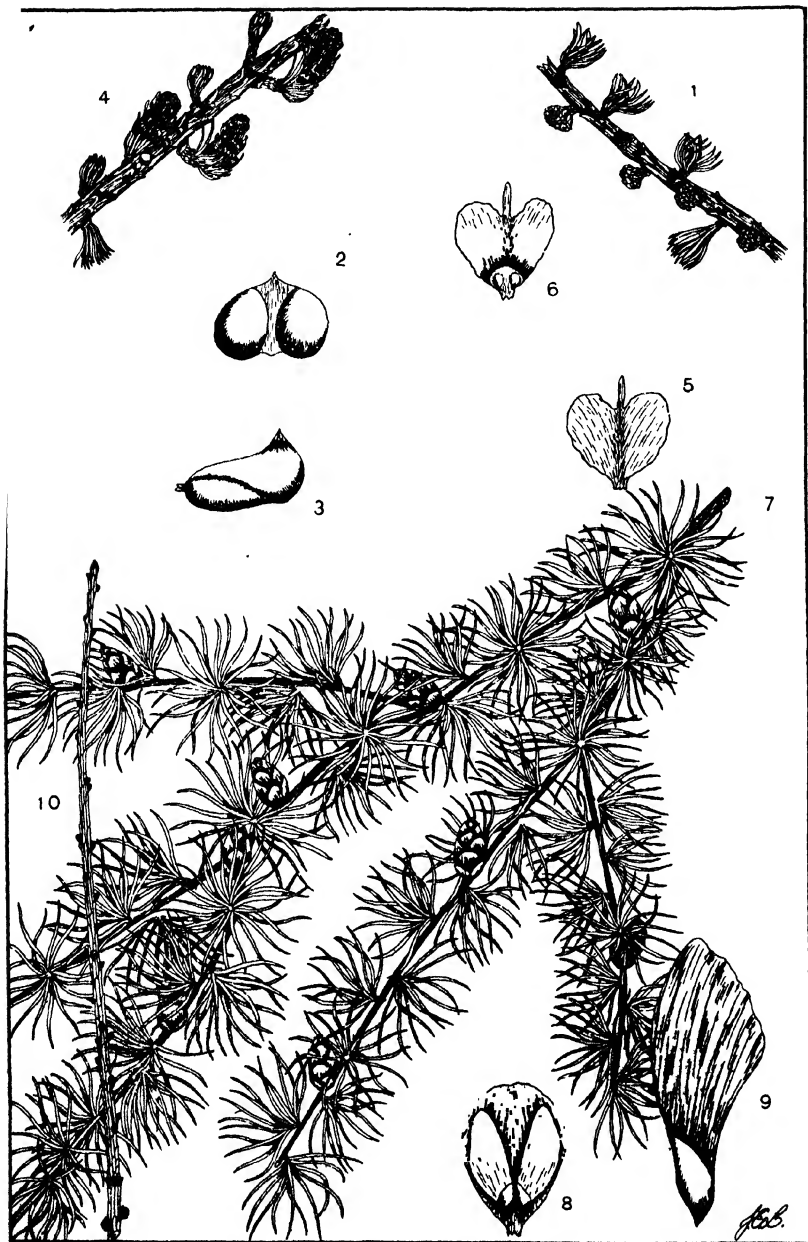
Fruit—An oblong-conical, prickly, bright green cone, $1\frac{1}{2}$ —2 $\frac{1}{2}$ inches long, often reflexed, nearly sessile, often slightly curved, attaining full size the second autumn, turning dark reddish-brown, and slowly setting free the seeds. Opened cones persist on the branches for 3—4 years. Cone-scales thin, flattened, terminated by a prickle. Seeds pale brown, winged, about $\frac{1}{4}$ of an inch long.

Winter characters—Branchlets slender, tough, rather flexible, at first glaucous and greenish purple, at length grayish brown. Buds $\frac{1}{3}$ — $\frac{1}{2}$ of an inch in length, ovate, acute, with ovate, acute, dark chestnut-brown scales, the scale-tips soon reflexed. Mature bark dark brown tinged with red, thin, shallowly fissured with scale-like plates.

Habitat—Thrives on poor, dry, sandy soils, spreading rapidly over abandoned fields and cut-over areas. Frequent on the sand-barrens of New Jersey.

Range—Long Island and Staten Island, N. Y., through central Pennsylvania to the Ohio River, along its north bank through Ohio and southern Indiana, south through Kentucky and west central Tennessee to central Alabama, east through central Georgia to the Coast.

Uses—Of little value as a timber tree in the east because of its small size. Wood light, soft, brittle, coarse-grained, durable in contact with the soil, pale orange with thick, nearly white sapwood. Used for fuel and occasionally converted into lumber. May eventually become valuable as a source of pulp because of its low resin content. In reforestation, important as a 'cover' tree because of its rapid regeneration on exhausted lands.



Tamarack, Larch, Hackmatack

Larix laricina (Du Roi) Koch. [*Larix americana* Michx.]

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover-scale, lower side x 5
6. Ovuliferous and cover-scales, upper side, showing ovules x 5
7. A fruiting branch showing mature cones x $\frac{1}{2}$
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 5
10. A winter twig x $\frac{1}{2}$

PINACEAE

Larix laricina (Du Roi) Koch. [*Larix americana* Michx.]

Tamarack, Larch, Hackmatack

Habit—A tree of medium stature, under optimum conditions sometimes 100 feet in height with a trunk diameter of $2\frac{1}{2}$ feet, usually much smaller, shrubby near the northern limit of its range. Crown in young trees narrowly pyramidal, often extending to the ground, in older trees in abundant light, forming a broad, open head. Branches slender, slightly ascending, feathery with the foliage. Very intolerant of shade.

Leaves—Linear, triangular in cross section (rounded above and ridged below), flexible, bright green, $\frac{3}{4}$ — $1\frac{1}{4}$ inches in length, deciduous in the autumn of the first year. On the growth of the season they occur singly in spirals, on the older growth in clusters terminating short lateral spurs.

Flowers—Appearing in May and June with the leaves, monoecious, borne in cones. Staminate cones arise laterally along the 1—2-year twigs, subglobose, sessile, about $\frac{1}{4}$ of an inch long, yellow at maturity. Ovulate cones lateral on 1—3-year twigs, scattered, oblong, about $\frac{1}{4}$ of an inch long, short-stalked, consisting of rose-colored bracts with green tips subtending rose-red fertile scales.

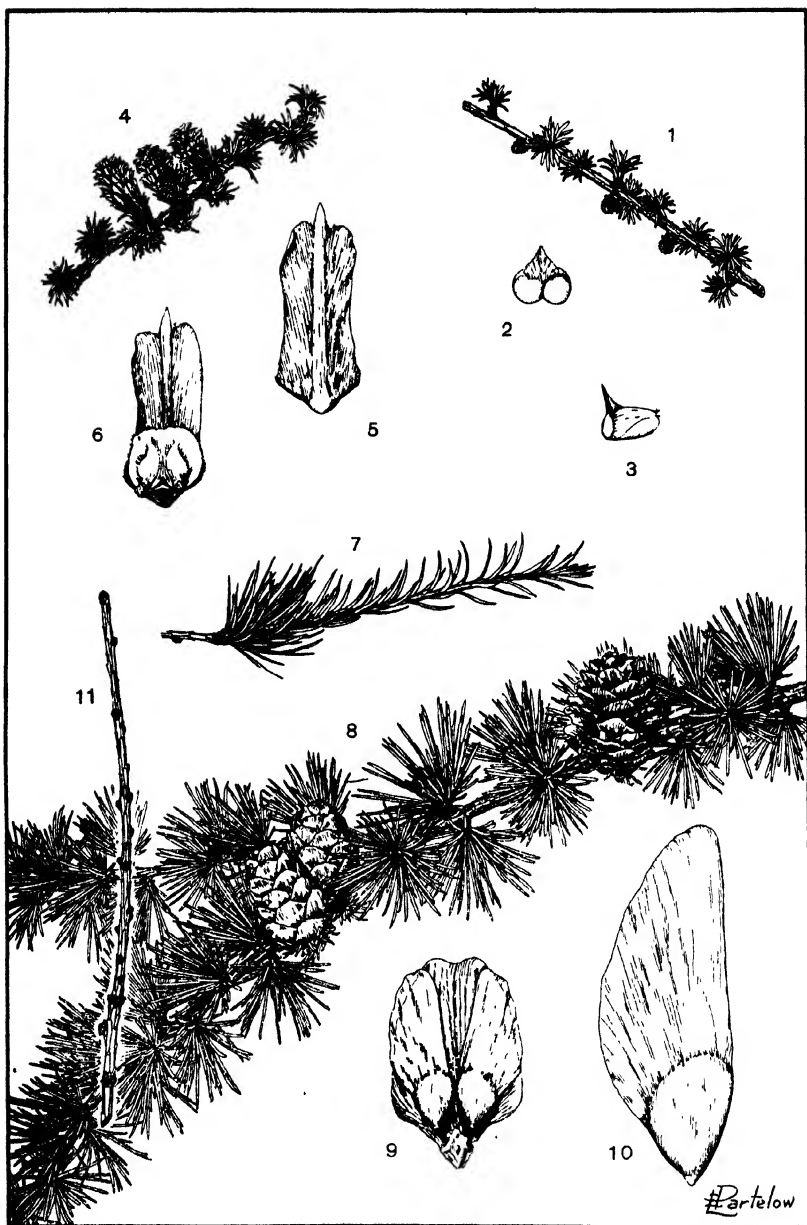
Fruit—A globose-ovoid, obtuse, chestnut-brown cone, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, borne on a stout, short, incurved stalk, attaining full size in the autumn of the first year and setting free its seeds during the fall and winter. Opened cones turn darker with age and persist on the twigs for a season or two. Cone-scales 12—15 in number, strongly concave and suborbicular, usually with erose margins. Seeds light brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Terminal branchlets light orange-brown with small, lustrous, globose, red buds. Two- and three-year branches darker, with short lateral spurs. Mature bark thin, close, separating at the surface into thin, reddish brown scales.

Habitat—In the southern part of its range, mostly confined to cold, springy swamps, further northward inhabiting well-drained uplands and hillsides. Extending to the limit of tree growth beyond the Arctic Circle and becoming greatly dwarfed.

Range—Newfoundland along the northern limit of tree growth to Alaska, south along the eastern base of the Rockies to southwestern Alberta, thence eastward through northeastern Minnesota. Wisconsin, northern Illinois, n. Indiana, n. Ohio and n. Pennsylvania to the Coast.

Uses—Wood hard, heavy, strong, coarse-grained, light brown with thin, nearly white sapwood, very durable in contact with the soil. Used largely in the 'round' or 'hewn' for fence posts, telegraph and telephone poles, railroad ties, etc. The tree is grown for ornament and is especially adapted, though not restricted, to moist sites. The Larch Saw Fly has caused great damage in certain sections by repeated defoliation.



European Larch

Larix decidua Will. [*Larix europaea* DC.; *Larix larix* Karst.]

1. A branch with staminate flowers x $\frac{1}{2}$
2. A stamen, front view x 4
3. A stamen, lateral view x 4
4. A branch with ovulate flowers x $\frac{1}{2}$
5. Cover-scale, lower side x 4
6. Ovuliferous and cover-scales, upper side x 4
7. Growth of the season showing spiral arrangement of the leaves x $\frac{1}{2}$
8. A fruiting branch showing mature cones x $\frac{1}{2}$
9. Scale from mature cone, upper side, showing seeds x 2
10. Winged seed x 5
11. Winter twig x $\frac{1}{2}$

PINACEAE

Larix decidua Will. [*Larix europaea* DC.; *Larix larix* Karst.]

European Larch

Habit—A large tree, usually 60—90 feet tall, under optimum conditions sometimes attaining a height of 140 feet with a trunk diameter of 2—3½ feet, at high elevations in the Alps of Central Europe reduced to a grotesquely dwarfed shrub. Crown pyramidal when young, consisting of wide-spreading branches bearing drooping branchlets and frequently extending well toward the ground, generally becoming irregular with age. Bole tapering.

Leaves—Linear, acute, flattened above and ridged below, soft, bright green as seen *en masse*, $\frac{3}{4}$ th—1½ inches in length, turning yellow and deciduous in the autumn of the first year. On the growth of the season they occur singly in spirals, on the older growth they are longer and narrower and are borne in clusters of 25—60 terminating short lateral spurs.

Flowers—Appearing in May and early June with the leaves, monoecious, borne in cones. Staminate cones terminal on lateral, leafless, short-branches along the 1—2-year twigs, subglobose, sessile, ascending, about $\frac{1}{4}$ th of an inch long, yellow at maturity. Ovulate cones lateral on 1—3-year twigs, scattered but often borne throughout the crown of the tree, subtended by a rosette of needles, oblong, $\frac{1}{2}$ —¾ths of an inch long, short-stalked, ascending, consisting of purple-red bracts prolonged into green caudate tips and subtending purple-red, fertile scales.

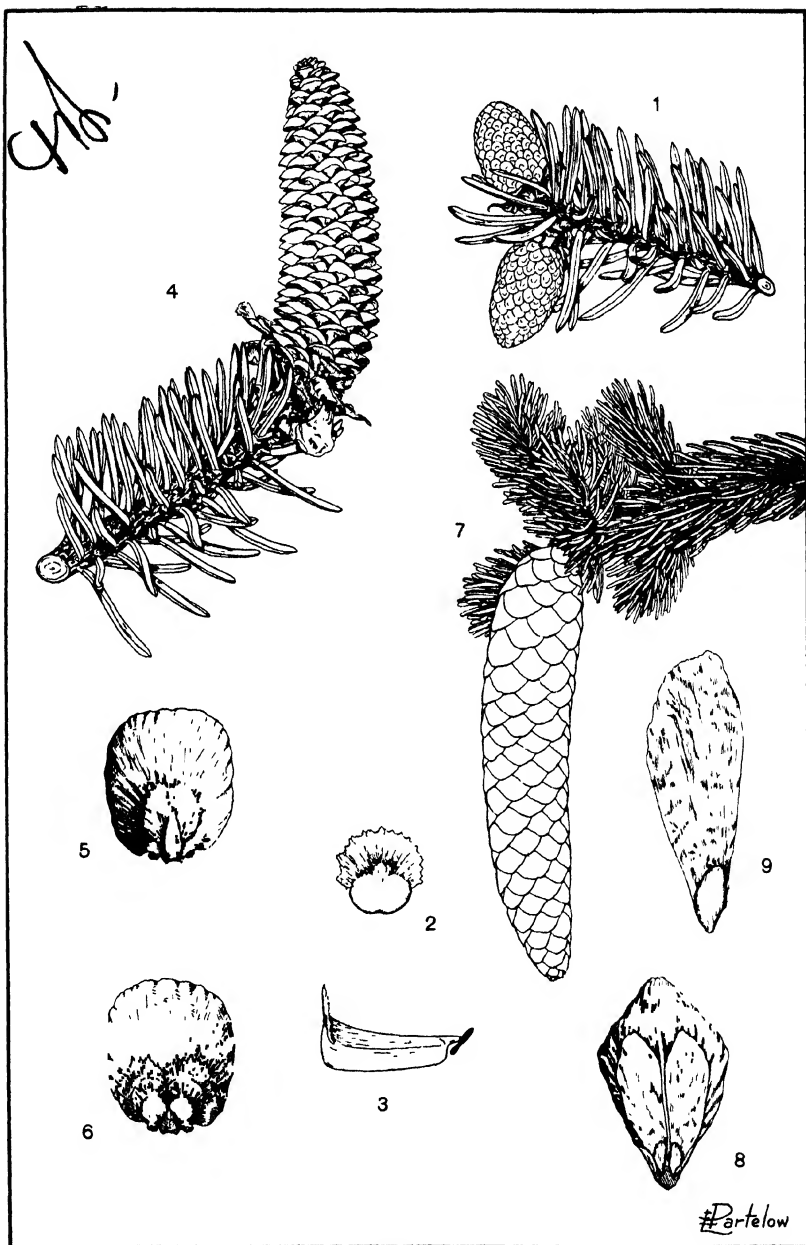
Fruit—An ovoid, obtuse, chestnut-brown cone. $\frac{4}{5}$ —1½ths inches long, borne upright on a stout, short, incurved stalk, attaining full size in the autumn of the first year and setting free its seeds during the following spring. Opened cones turn darker with age and persist on the twigs for a number of years. Cone-scales 40—50 in number, suborbicular and strongly concave, puberulous or tomentulose on the outside. Seeds light brown, winged, about $\frac{1}{8}$ th of an inch long.

Winter Characters—Terminal branchlets yellowish, rather stout [paler in color and stouter than those of *Larix laricina* (Du Roi) Koch.], with small, globose, reddish buds. Two- and three-year branches darker, with short, lateral spurs. Mature bark thick, scaly, dark greyish brown, forming red patches where freshly exposed.

Habitat—A moisture-loving species which grows on a variety of soils and endures extreme cold. Very intolerant of shade and more sensitive in its light requirements than most trees.

Range—Introduced originally into the United States as an ornamental tree and now used in forest planting as well. Native to the Old World with the center of distribution in the Alps of Central Europe where it occasionally reaches an altitude of 7,500 feet. Sparingly naturalized in the Northeast.

Uses—Extensively grown as an ornamental in parks, cemeteries, and on private grounds in eastern United States. The wood is heavy, hard, strong, with reddish brown heartwood and thin yellowish white sapwood; it is extremely durable in contact with the soil and is extensively used abroad because of its strength and durability. American-grown lumber from forest plantations in the United States is not as yet available in any quantity.



Norway Spruce

Picea abies Karst. [*Picea excelsa* Link]

1. A branch with staminate flowers x 1
2. A stamen, front view x 5
3. A stamen, lateral view x 5
4. A branch with an ovulate flower x 1
5. Cover- and ovuliferous scales, lower side x 5
6. Ovuliferous scale, upper side, showing ovules x 5
7. A fruiting branch showing a mature cone x $\frac{1}{2}$
8. Scale from mature cone, upper side, showing seeds x 1
9. Winged seed x 2

PINACEAE

Picea abies Karst. [*Picea excelsa* Link]

Norway Spruce

Habit—Very variable in size; a large tree, usually 60–90 feet tall when grown as an ornamental in eastern United States, under optimum conditions within its natural range attaining a maximum height of 150–180 feet with a trunk 3–6 feet in diameter, in the far north often reduced to a bush or prostrate shrub which spreads by 'layering'. Crown pyramidal, rather narrow, consisting of sloping, horizontal or ascending branches and usually pendent branchlets, extending well toward the ground in the open, shortened in forest-grown trees. Bole tapering.

Leaves—Borne on persisting sterigmata in close spirals, on vertical shoots preserving their obvious spiral arrangement, those on the underside of inclined or nearly horizontal twigs curving upward and causing the foliage to appear crowded on the upper side of the twig, linear, 4-sided, dark green and usually lustrous at maturity, with an acute, hard, yellow apex, generally $\frac{1}{2}$ –1 inch long, persisting on the tree 8–9 (rarely 12) years.

Flowers—Appearing in May and early June, monoecious, borne in cones. Staminate cones axillary or subterminal, solitary on stalks about $\frac{1}{4}$ of an inch long, $\frac{1}{2}$ – $\frac{3}{4}$ ths of an inch long, erect or nearly so, strawberry-pink just prior to anthesis, the pink becoming flecked with yellow as the pollen is released. Ovulate cones terminal, solitary on separate branches and usually most abundant toward the top of the crown, cylindrical, 2–2 $\frac{1}{2}$ inches long, erect, purplish red at pollination, the exposed terminal portion of the ovuliferous scales reflexed.

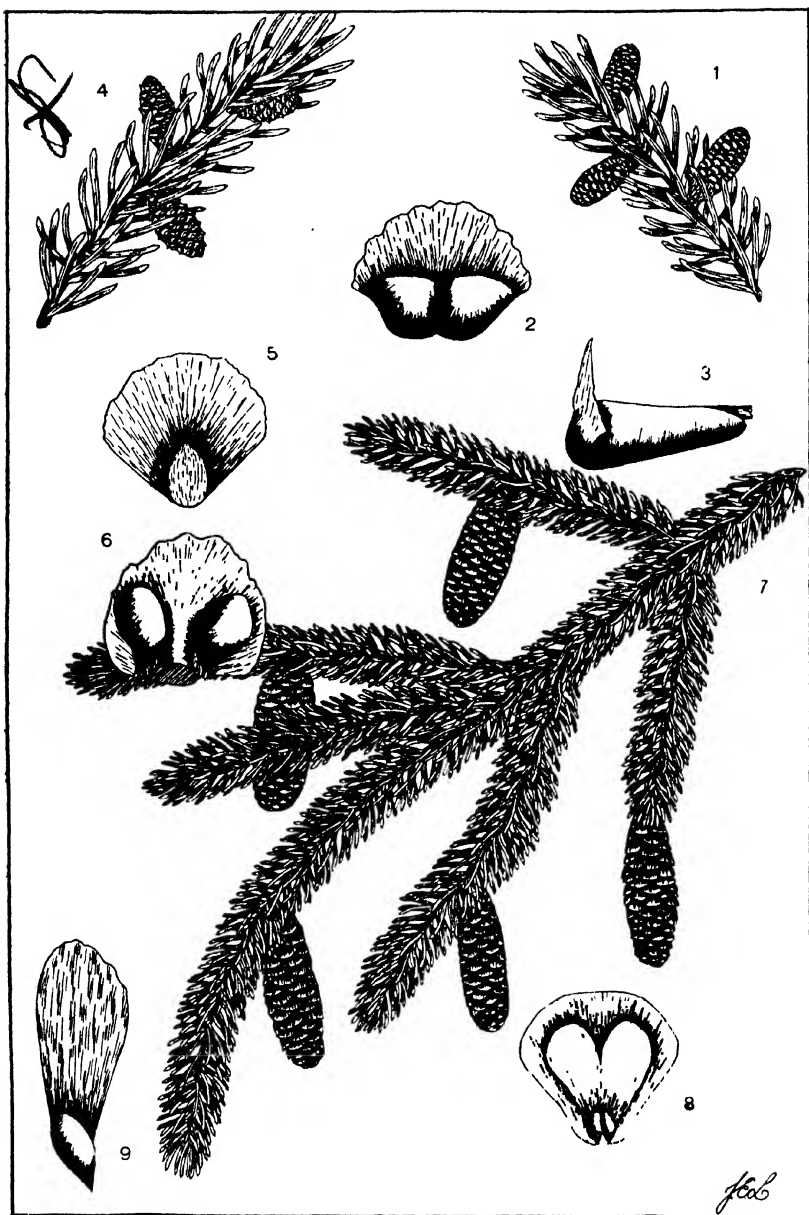
Fruit—A cylindrical, purplish violet or green, pendulous cone, 4–6 inches in length, attaining full size by the middle of the summer, turning light brown and ripening in October, the middle scales of the cone fertile and usually setting free the seeds the following spring, the cones generally persisting on the trees for about a year and then falling as a whole. Cone-scales thin, rhombic-ovate, with a truncate, erose-denticulate, or emarginate apex. Seeds brown, winged, about $\frac{1}{8}$ ths of an inch long.

Winter Characters—Branchlets stout, glabrous or subglabrous, brown or orange-brown during the first autumn and winter, becoming darker with age. Buds $\frac{1}{8}$ ths to $\frac{1}{4}$ ths of an inch in length, devoid of resin, ovate-conical, acute, reddish or light brown, the scales often with spreading tips. Terminal bud with a few acuminate, keeled, pubescent scales at the base. Mature bark reddish brown, thin, roughened with flaky scales, on younger trunks smooth or with very thin flaky scales.

Habitat—Cannot exist on very dry soils but otherwise not exacting in its site requirements. Thrives best on well drained soils but also grows in wet swamps. Tolerant and hence able to grow under forest cover.

Range—Native to central and northern Europe, reaching as far north as Lapland and extending into Asia. Sparingly naturalized in the Northeast.

Uses—Originally introduced into eastern United States as an ornamental and now widely grown, with its various varieties, for this purpose. It has proven to be superior to any of our native spruces in reforestation because of its vigor and rate of growth, and is now extensively used in forest planting, either in pure stands or in admixture with other conifers. Wood light, soft, fine grained, weak, lustrous, pale yellowish white with scarcely distinguishable sapwood. Extensively used in Europe for pulp and for lumber where a soft, even-grained coniferous wood is required. Pulpwood shipments of this species have been made to the United States and Canada at various times in recent years, often to the disadvantage of American pulpwood. Wood from American-grown plantations is not available as yet in any quantity.



White Spruce, Cat Spruce

Picea glauca (Moench.) Voss. [*Picea canadensis* (Mill) B. S. P.;
Picea alba Link]

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover- and ovuliferous scales, lower side x 8
6. Ovuliferous scale, upper side, showing ovules x 8
7. A fruiting branch showing mature cones x $\frac{1}{4}$
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 4

PINACEAE

Picea glauca (Moench.) Voss. [*Picea canadensis* (Mill.) B. S. P.;
Picea alba Link]

White Spruce, Cat Spruce

Habit—A tree in the East attaining a height of 60—70 feet at maturity, with a trunk diameter of 2 feet, in the western part of its range sometimes becoming 120 feet in height. Crown irregularly and openly pyramidal, obtuse at the apex, consisting of long, rather stout, upcurving branches which are densely clothed with pendent laterals.

Leaves—Borne on sterigmata in dense spirals, those on the under side curving upward and causing the foliage to appear crowded on the upper side of the twigs, awl-shaped, 4-sided, acute to acuminate at the apex, glaucous green when young, becoming dark bluish green, $\frac{3}{4}$ — $\frac{1}{2}$ of an inch long, falling gradually after 7—10 years. The foliage has a rank odor when crushed, hence the name, Cat Spruce.

Flowers—Appearing in May and early June, monoecious, borne in cones. Staminate cones terminal or subterminal, borne on stalks nearly $\frac{1}{2}$ of an inch long, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, reddish yellow at maturity. Ovulate cones terminal or subterminal, borne on different branches, oblong-cylindrical, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, reddish or yellowish green at pollination.

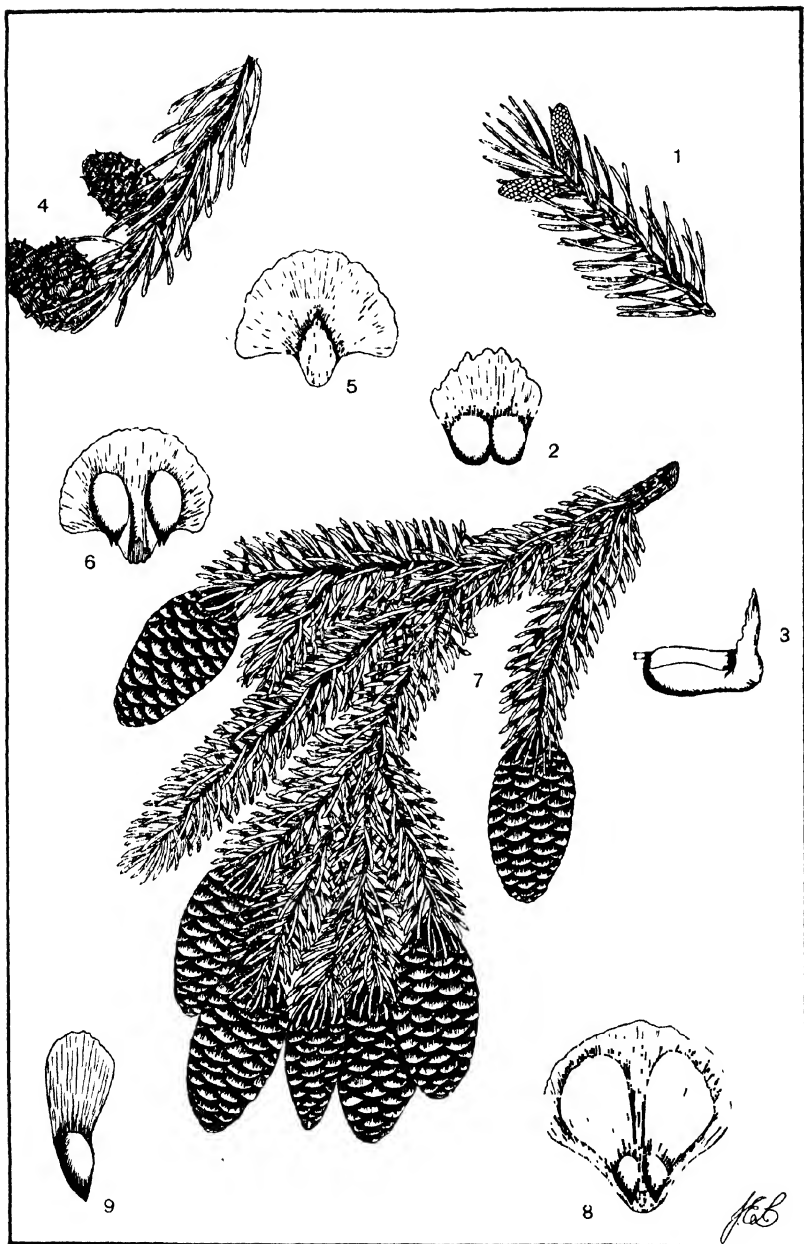
Fruit—A cylindric-oblong, nearly sessile, green cone, about 2 inches long, attaining full size by the middle of the summer, at maturity turning pale brown and shining, falling during the autumn soon after the seeds are set free. Cone-scales suborbicular, thin and flexible, with rounded entire margin. Seeds brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Branchlets stout, yellowish gray to pale brown during the first autumn and winter, at length dark grayish brown. Buds $\frac{1}{8}$ — $\frac{1}{4}$ of an inch in length, broadly ovate, blunt, with light chestnut, ciliate scales rounded at the apex. Mature bark gray tinged with brown, thin, separating into thin, plate-like scales.

Habitat—Typically found on low, moist, alluvial soils along the banks of streams, shores of lakes and ponds, and the borders of swamps. In the Northeast occurring along the sea-cliffs where it is continually bathed with salt spray. Extending in the far north, in company with Tamarack and Black Spruce, to the limit of tree growth beyond the Arctic Circle.

Range—Newfoundland along the northern limit of tree growth to the west coast of Alaska, south to northern New England and northern New York, southern Ontario, central Michigan and Wisconsin, thence northwestward through central Minnesota into Canada, south along the Rockies to northwestern Montana, northward along this range to northern British Columbia and thence to the Pacific Ocean.

Uses—The most important eastern spruce and a valuable timber tree within its optimum range. Wood light, soft, fine-grained, weak, light yellow with scarcely distinguishable sapwood. Usually not separated in the trade from that of Red Spruce and used for similar purposes. The principal source of wood pulp at the present time.



Red Spruce

Picea rubens Sarg. [*Picea rubra* Link, not A. Dietr.]

- | | |
|---|---|
| 1. A branch with staminate flowers x 1 | 6. Ovuliferous scale, upper side, show- ing ovules x 5 |
| 2. A stamen, front view x 5 | 7. A fruiting branch showing mature cones x 1/2 |
| 3. A stamen, lateral view x 5 | 8. Scale from mature cone, upper side, showing seeds x 2 |
| 4. A branch with ovulate flowers x 1 | 9. Winged seed x 2 1/2 |
| 5. Cover- and ovuliferous scales, lower side x 5 | |

PINACEAE

Picea rubens Sarg.[*Picea rubra* Link, not A. Dietr.]

Red Spruce

Habit—A tree at maturity attaining a height of 70—80 feet, with a trunk diameter of 2—3 feet, occasionally becoming 100 feet tall, on high mountain slopes often dwarfed and shrubby. Crown, where light permits, narrowly conical, consisting of slender spreading branches reaching nearly or quite to the ground. When crowded in the forest, the crown is greatly reduced in size (sometimes to a mere tip), leaving the bole clean for two-thirds of its length.

Leaves—Borne on sterigmata in close spirals, standing out from all sides of the branches, ascending, awl-shaped, 4-sided, blunt or acute at the apex, curved inward above the middle, yellowish green and lustrous at maturity, $\frac{1}{2}$ — $\frac{3}{8}$ of an inch long, falling gradually after the sixth year.

Flowers—Appearing in April and May, monoecious, borne in cones. Staminate cones terminal or subterminal, short-stalked, about $\frac{1}{2}$ of an inch long, oval, bright red at maturity. Ovulate cones terminal or subterminal, on different branches, oblong-cylindrical, about $\frac{3}{4}$ of an inch in length, reddish green at pollination.

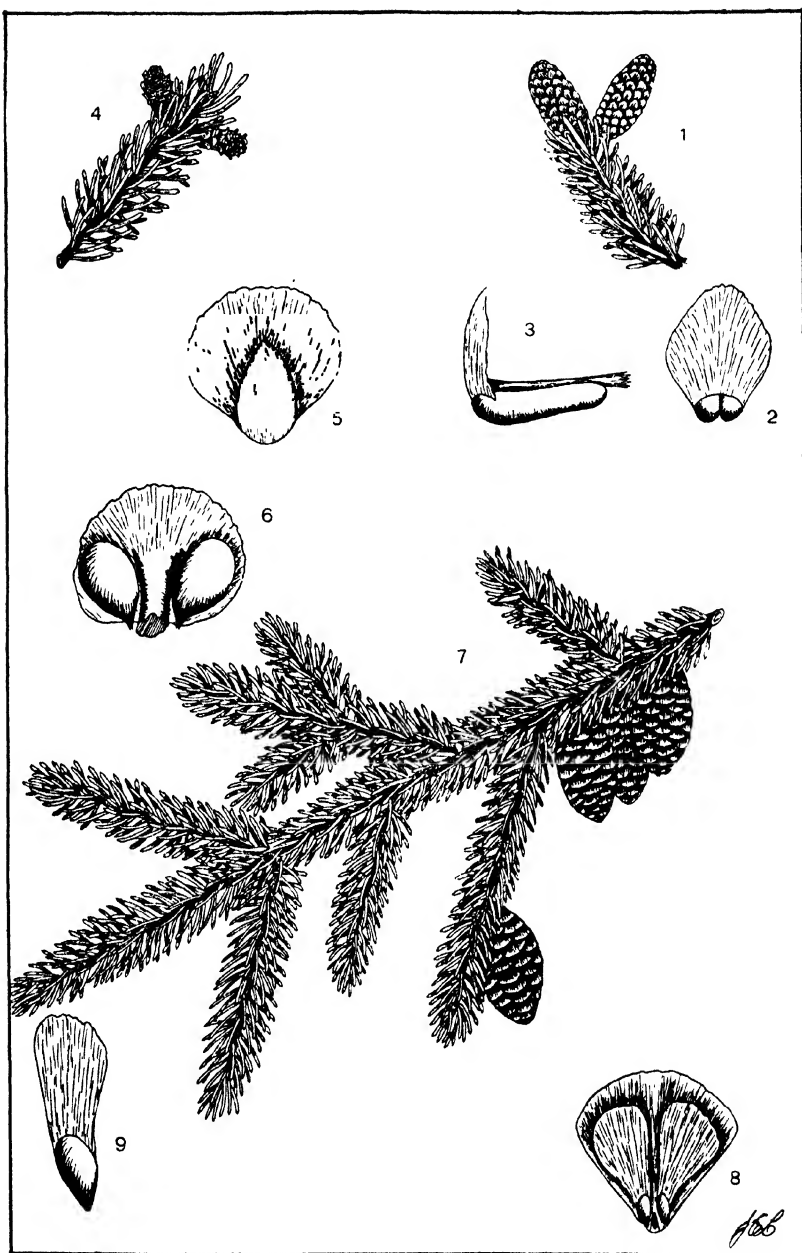
Fruit—An ovoid-oblong, green or purplish green cone, $1\frac{1}{4}$ —2 inches in length, borne on short, usually straight peduncles, attaining full size by the middle of the summer, turning light reddish brown and shining at maturity, opening and beginning to fall in the late autumn, a few persisting until the following summer. Cone-scales rigid, rounded, with entire margin. Seeds dark brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Branchlets rather stout, light reddish or orange-brown, covered with rusty-brown hairs, becoming dark brown and smooth the second season. Three- and four-year branches scaly. Buds $\frac{1}{4}$ — $\frac{1}{2}$ of an inch in length, ovate, acute, with closely appressed, acute scales. Mature bark reddish brown, thin, flaking off in thin scales.

Habitat—Attaining its best development on well-drained uplands, tablelands, and mountain slopes, in pure stands or often in admixture with Yellow Birch, Beech, Maple, Balsam Fir, Hemlock and White Pine, likewise invading swamps in company with Black Spruce and Tamarack. The common spruce of the mountainous regions of New York, Vermont and New Hampshire. Thrives well on thin soils. A very tolerant species.

Range—New Brunswick and Nova Scotia south along the coast to Massachusetts, thence in the mountains to northern Georgia, along the north bank of the St. Lawrence to Lake Ontario, south through western New York and western Pennsylvania to eastern Tennessee, up to 3500 feet elevation in the South.

Uses—An important timber tree, ranking second only to White Pine in the Northeast as a timber-producing species and, due to the exhausted supply of the last, the most important timber tree of the forests of the Northeastern States. Wood light, soft, even-grained, reddish yellow with nearly white sapwood, resonant. Largely manufactured into lumber and used for a variety of purposes where a soft, easily worked wood is required. This wood and White Spruce are the best for the sounding boards of musical instruments because of their resonant qualities. An important source of chemical wood pulp. Also used for containers for foods subject to taint.



Black Spruce

Picea mariana (Mill.) B. S. P. [*Picea nigra* (Ait.) Link]

1. A branch with staminate flowers $\times \frac{1}{2}$
2. A stamen, front view $\times 10$
3. A stamen, lateral view $\times 10$
4. A branch with ovulate flowers $\times \frac{1}{2}$
5. Cover- and ovuliferous scales, lower side $\times 8$
6. Ovuliferous scale, upper side, showing ovules $\times 8$
7. A fruiting branch showing mature cones $\times \frac{1}{2}$
8. Scale from mature cone, upper side, showing seeds $\times 2$
9. Winged seed $\times 4$

PINACEAE

Picea mariana (Mill.) B. S. P. [*Picea nigra* (Ait.) Link]

Black Spruce

Habit—Usually a small tree 10–30 feet in height with a trunk diameter of 4–12 inches, occasionally at its optimum range reaching a height of 100 feet. An extremely variable form. Crown narrowly pyramidal, irregular and open, in exposed trees often extending to the ground. Branches short, declined but curved upward at the ends, the basal ones frequently taking root and sending up shoots (layering).

Leaves—Borne on sterigmata in close spirals, standing out from all sides of the branches, awl-shaped, 4-sided, blunt at the apex, straight or slightly curved, bluish green, $\frac{1}{4}$ – $\frac{3}{4}$ of an inch long, falling gradually after 7–10 years.

Flowers—Appearing in May and early June, monoecious, borne in cones. Staminate cones terminal or subterminal, almost sessile, about $\frac{1}{8}$ of an inch long, cylindrical to subglobose, dark red at maturity. Ovulate cones terminal or subterminal, on different branches, oblong-cylindrical, about $\frac{1}{8}$ of an inch long, purple at pollination.

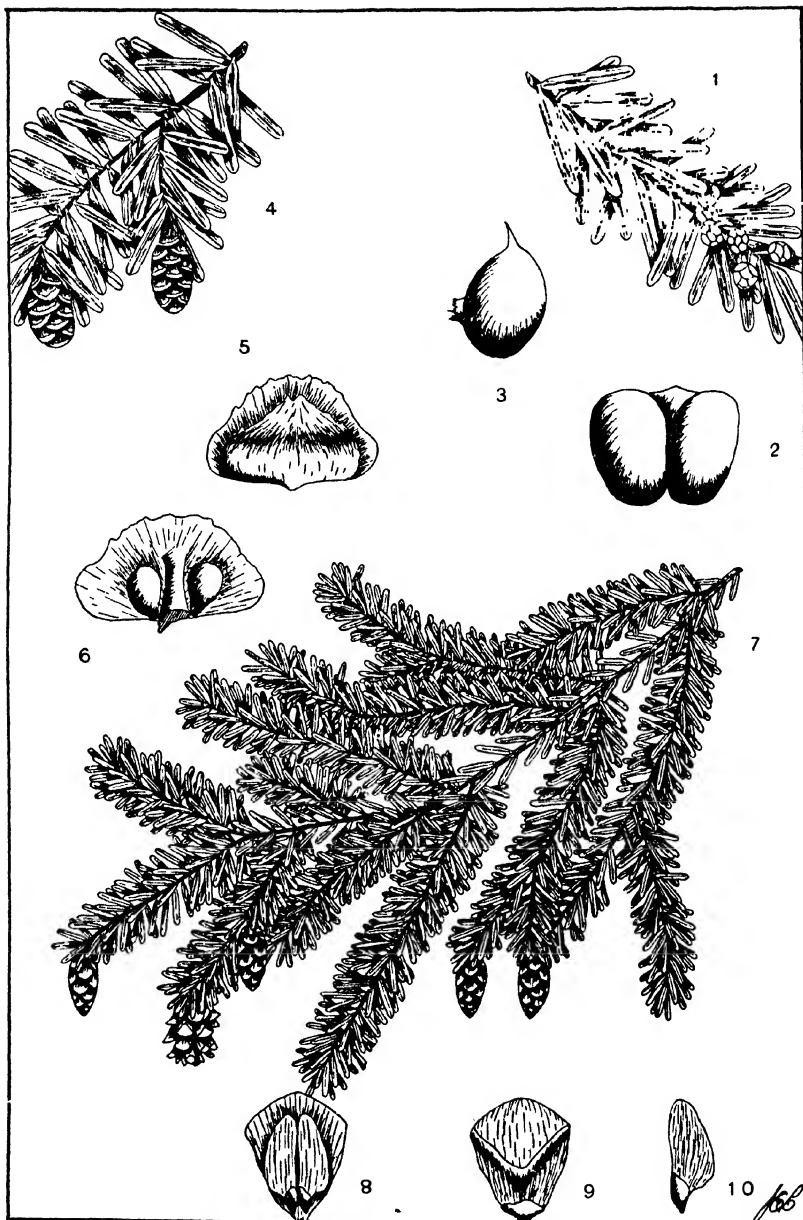
Fruit—An ovoid, purplish brown cone, $\frac{1}{2}$ – $1\frac{1}{2}$ inches in length, borne on short incurved peduncles, strongly reflexed, attaining full size early in the summer, turning grayish brown and opening gradually in the autumn but remaining on the trees many years. Cone-scales rigid, nearly orbicular, with erose margins. Seeds dark brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Branchlets at first light or yellowish brown and covered with short rusty hairs, during the second year becoming dark brown, glabrous, and scaly. Buds $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, ovate, acute, puberulent, light reddish brown, with closely appressed scales. Mature bark grayish brown, thin, flaky, with appressed scales.

Habitat—Typically found in sphagnum bogs and cold, springy swamps, more rarely on drier, better-drained uplands and rocky slopes. Forms pure stands or often mixed with Tamarack, Balsam Fir, White Cedar, Black Ash, etc. In company with Tamarack, extending northward to the limit of tree growth where specimens two or three feet in height are found bearing cones.

Range—A transcontinental species extending from Labrador to Alaska, south along the coast to New Jersey and in the mountains to northern Virginia, thence westward through western Pennsylvania, the southern peninsula of Michigan, central Wisconsin and northeastern Minnesota into Canada.

Uses—Seldom sawed into timber in the Northeast because of its small stature. Wood light, soft, weak, pale yellowish white with thin sapwood. Imported from Canada along with White Spruce for the manufacture of chemical pulp. Varieties of the Black Spruce (as the Hudson Bay form) are used ornamentally. Often cut for Christmas trees.



Hemlock

Tsuga canadensis (L.) Carr.

1. A branch with staminate flowers x 1
2. A stamen, front view x 20
3. A stamen, lateral view x 20
4. A branch with ovulate flowers x 1
5. Cover- and ovuliferous scales, lower side x 10
6. Ovuliferous scale, upper side, showing ovules x 10
7. A fruiting branch showing mature cones x $\frac{1}{2}$
8. Scale from mature cone, upper side, showing seeds x 2
9. Scale from mature cone, lower side x 2
10. Winged seed x 3

PINACEAE

Tsuga canadensis (L.) Carr.

Hemlock

Habit—A tree at maturity usually 60—70 feet tall with a trunk diameter of 2—3 feet, under optimum conditions occasionally becoming 125 feet in height. With sufficient light the crown is obtusely pyramidal and broad-based, consisting of horizontal branches (the lower pendulous) which extend to the ground. Under forest conditions, the trunk is often devoid of branches for two-thirds of its length and exhibits decided taper. Branches and foliage arranged in flat-topped sprays.

Leaves—Borne spirally on the branches but appearing two-ranked due to a twist in the petioles, those on the upper surface of the spray much shorter than the laterals, oblong-linear, flat, obscurely grooved, rounded or notched at the apex, often obscurely denticulate, dark yellowish green and lustrous above, with two broad, white-glaucous lines beneath, each line consisting of 5—6 rows of stomata, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, about $\frac{1}{8}$ of an inch wide.

Flowers—Appearing in May, monoecious, borne in cones. Staminate cones borne near the ends of the branches on the growth of the previous season, axillary, on slender stalks, about $\frac{3}{8}$ of an inch long, subglobose, yellow at maturity. Ovulate cones terminal, oblong, about $\frac{1}{8}$ of an inch long, pale green at pollination.

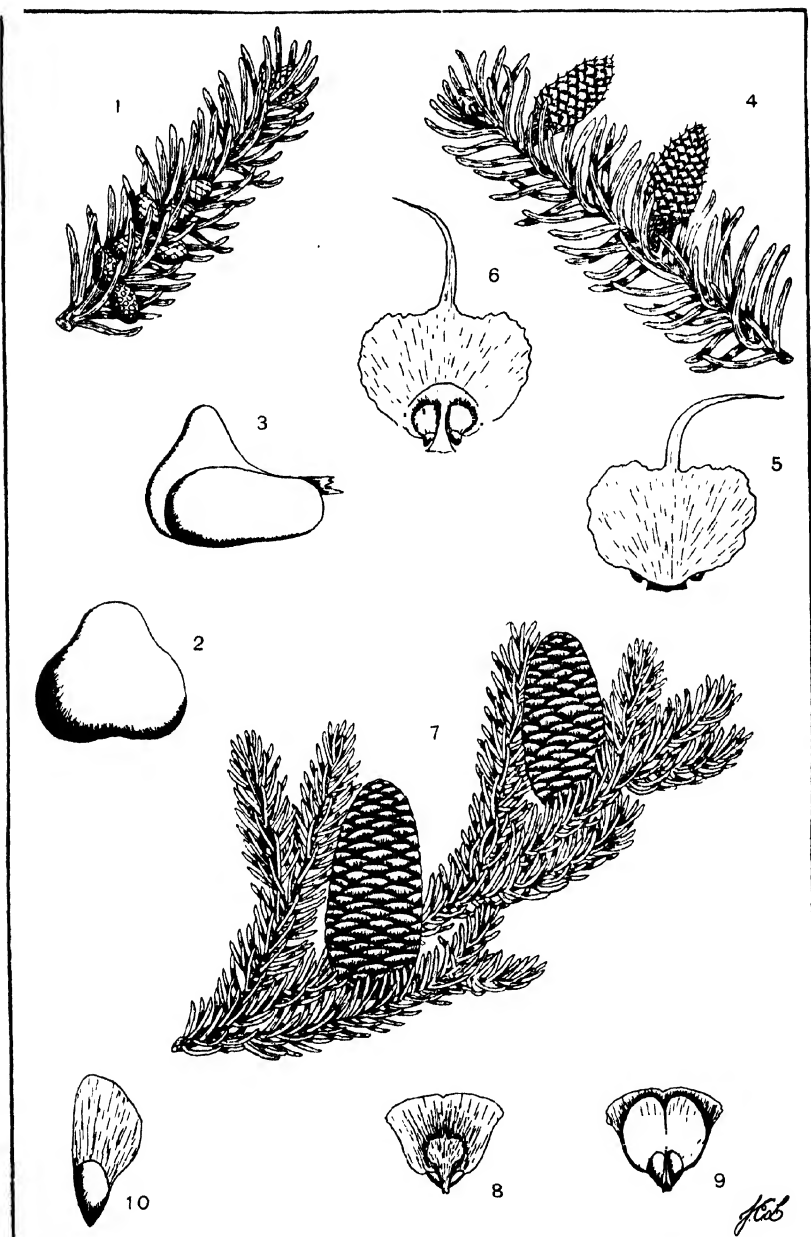
Fruit—An ovate-oblong, pale green cone, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, suspended on a slender, puberulous peduncle, attaining full size in the summer and turning reddish or grayish brown in the autumn, gradually setting free the seeds during the winter and falling in the spring of the second year. Cone-scales orbicular to obovate, slightly thickened above. Seeds light brown, winged, about $\frac{1}{8}$ of an inch long.

Winter characters—Branchlets during the first winter yellowish brown and pubescent, becoming dark grayish or purplish brown and glabrous the third season. Buds about $\frac{1}{8}$ of an inch in length, ovate, obtuse, slightly puberulous, light chestnut-brown. Mature bark reddish or grayish brown, thick, deeply divided by long fissures into broad ridges, closely scaly on the surface.

Habitat—A very tolerant, moisture-loving tree, occurring on damp soils along stream courses, the south side of glens, northern slopes, borders of lakes and ponds, and margins of swamps. Reaches its best development under dense forest conditions where it frequently forms an understory under White Pine and the northern hardwoods. Shallow-rooted and subject to wind fall.

Range—Nova Scotia west through southern Quebec, Ontario, Michigan and Wisconsin to eastern Minnesota, south along the Appalachians to Georgia and Alabama. Attains its best development in the southern Appalachians.

Uses—Formerly despised as a source of timber. With the depletion in the supply of the more valuable species, Hemlock has come to be an important timber tree. Wood light, hard, brash, coarse-grained, splintery, subject to shake, light brown tinged with red. Chiefly manufactured into lumber of the coarser grades. The wood is also widely used for 'ground wood' pulp. Hemlock bark is a source of tannin in the Northeastern States.



Balsam Fir, Balsam

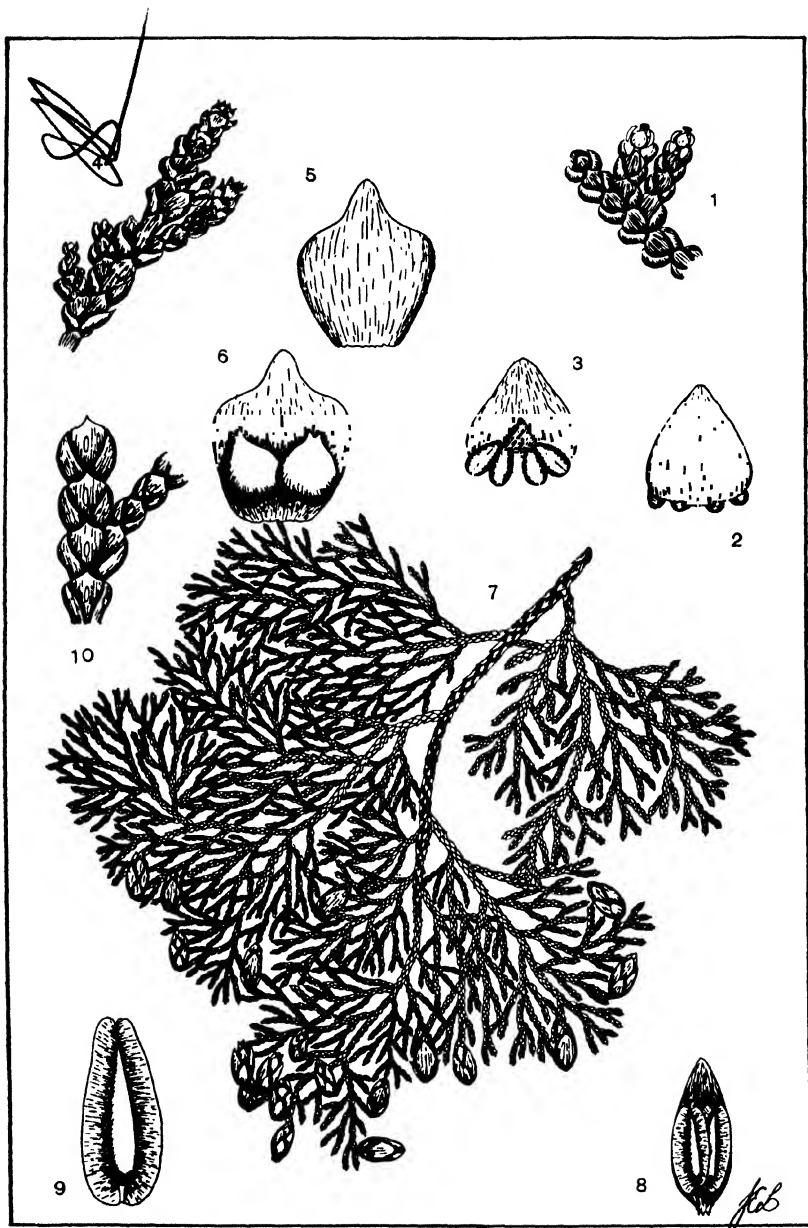
Abies balsamea (L.) Mill.

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover-scale, lower side x 15
6. Cover- and ovuliferous scales, upper side, showing ovules x 15
7. A fruiting branch showing mature cones x $\frac{1}{2}$
8. Scale and subtending bract from mature cone, lower side x 1
9. Scale from mature cone, upper side, showing seeds x 1
10. Winged seed x $1\frac{1}{2}$

PINACEAE

Balsam Fir, Balsam *Abies balsamea* (L.) Mill.

- Habit**—A tree usually 40—60 feet in height with a trunk diameter of 1—1½ feet, under optimum conditions sometimes attaining a height of 80 feet. In young trees growing in the open, the crown is pyramidal, open, and broad-based, consisting of slender, elongated, horizontal branches in rather distant whorls of 4—5, the lower sometimes slightly pendulous. Under crowded forest conditions the lower branches subsequently die, leaving a reduced spire-like crown.
- Leaves**—Borne spirally, stalkless, oblong-linear, flat, generally blunt, entire margined, dark green and shining above, with 2 broad, white-glaucous lines beneath which consist of about 6 rows of stomata, ½—1¼ inches long, about ⅓ of an inch wide. The leaves on the young growth or sterile branches appear 2-ranked and spread at right angles to the twig; those near the top of the crown are incurved, almost erect, and clothe the branches on the upper side.
- Flowers**—Appearing in May, monoecious, borne in cones. Staminate cones borne on the growth of the preceding season from axillary buds, clothed at the base by persisting bud-scales, oval to oblong-cylindrical, at maturity yellow tinged with reddish purple. Ovulate cones borne similarly but confined to the upper side of the topmost branches, erect, oblong-cylindrical, about 1 inch long, consisting of purple bracts with green, caudate tips.
- Fruit**—An erect, oblong-cylindrical, puberulous, dark purple cone, 2—4 inches long, rounded at the apex, usually bearing globules of resin, maturing in the autumn of the first year. Cone-scales usually slightly longer than broad, thin, fan-shaped, longer than the bracts, deciduous from the upright cone-axis. Seeds winged, about ¼ of an inch long, equipped with resin vesicles.
- Winter characters**—Branchlets slender, usually borne opposite, pubescent, at first yellowish green, becoming at length grayish brown tinged with purple, smooth and somewhat lustrous. Buds about ½ of an inch long, clustered at the ends of the twigs, globose to ovate, covered with a resinous exudation, with dark orange-green, lustrous bud-scales. Bark on young branches pale gray, thin, smooth, marked by raised areas denoting the presence of resin cysts. Mature bark pale reddish brown, separating into small, irregular, scaly plates.
- Habitat**—Thrives best on moist sites in swamps and peat bogs, or on mountain tops and slopes where condensation offers sufficient moisture. A common tree in low situations associated with Red and Black Spruce, Tamarack, and Hemlock. Occasionally in pure stands. One of the most tolerant coniferous species of the East.
- Range**—Southeastern Labrador through Quebec, Ontario, and central Manitoba to southwestern Mackenzie and the headwaters of the Yukon, in the northern border states from Maine to Minnesota with the exception of Ohio, northeastern Iowa, south through New England and New York and, in the mountains, to Virginia and West Virginia.
- Uses**—Of little value as a source of lumber. Wood light, soft (of cheesy consistency when green), coarse-grained, not durable, pale brown tinged with yellow, with thick, lighter sapwood. Used with more valuable species in the manufacture of pulp. Balsam is occasionally used ornamentally and as a Christmas tree. The 'Canada balsam' of commerce, noted for its medicinal properties and as a cement for glass, is obtained from the resin blisters in the bark.



Northern White Cedar, Arbor Vitae

Thuja occidentalis L.

1. A branch-tip with staminate flowers x 2
2. A stamen, front view x 10
3. A stamen, axile view x 10
4. A branch-tip with ovulate flowers x 2
5. Ovulate cone-scale, lower side x 10
6. Ovulate cone-scale, upper side, showing ovules x 10
7. A fruiting spray showing mature cones x 1/2
8. Scale from mature cone, upper side, showing seeds x 4
9. Winged seed x 8
10. Sterile branch-tip showing decussate, glandular leaves x 2 1/2

PINACEAE
Thuja occidentalis L.

Northern White Cedar, Arbor Vitae

Habit—A tree at maturity attaining a height of 50—60 feet with a trunk diameter of 2—3 feet, under optimum conditions sometimes becoming 70 feet tall. Crown dense, pyramidal, rather wide-based, often extending nearly to the ground. Trunk usually short, tapering, often lobed and buttressed, sometimes twisted, commonly dividing into several upright secondary stems. Lateral branches short, horizontal or often declined, with short pendulous laterals arranged in a horizontal plane. The laterals at length die and are cast off with the leaves.

Leaves—Opposite, yellowish green; on the thrifty shoots they are scale-like, closely imbricated, ovate to lanceolate, pointed at the apex, glandular on the back, aromatic when crushed, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long; on the deciduous laterals they are much smaller, of two kinds in alternating pairs, those on the side of the twig strongly keeled, those on the face flat and usually glandular, giving the twigs a flattened appearance.

Flowers—Appearing in April and May, monoecious, borne in cones on different branches. Staminate cones terminal, solitary, about $\frac{1}{8}$ of an inch long, ovoid to globose, consisting of 4—6 stamens, yellow at maturity. Ovulate cones terminal, solitary, similar in size, ovoid, consisting of 4—6 pairs of thin scales, pinkish at pollination. Ovules borne in pairs.

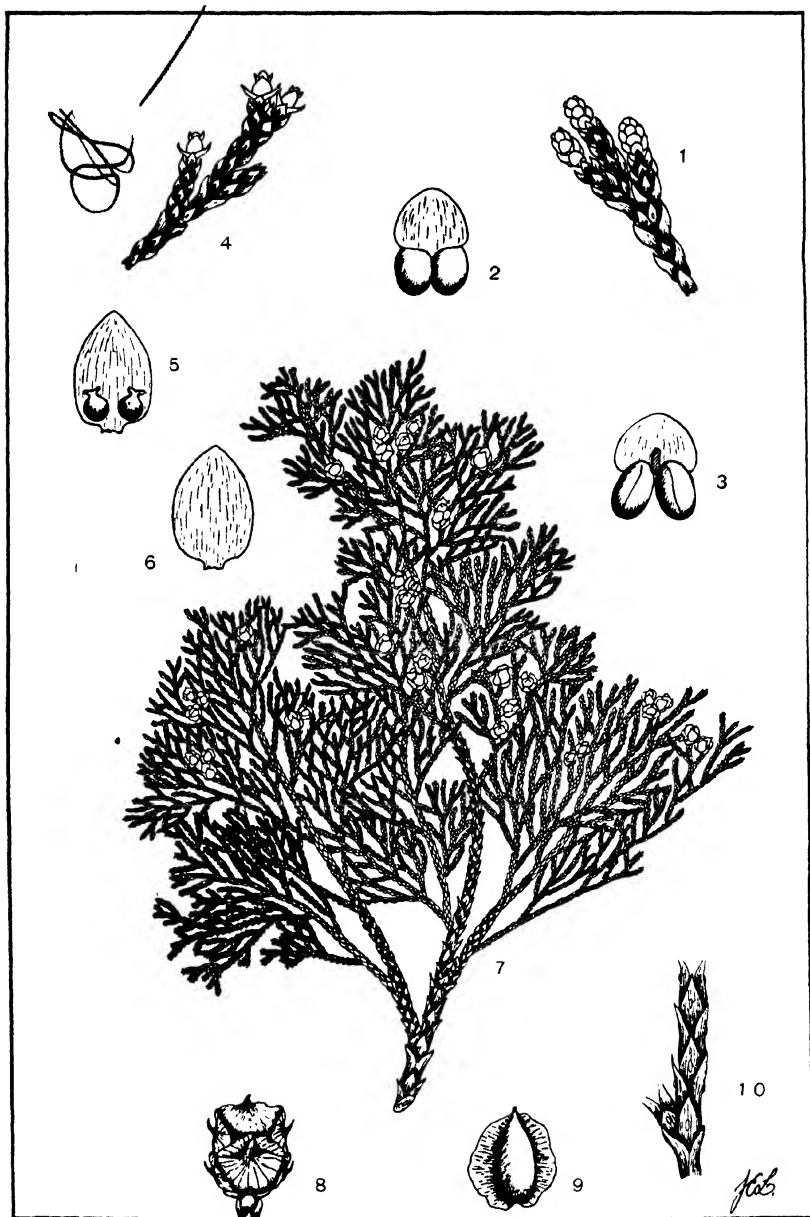
Fruit—An oblong, erect, green cone, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, consisting of 6—12 obtuse scales, attaining full size by the middle of the summer, turning pale cinnamon-brown and opening in the autumn, persisting during the following winter. Cone-scales thin, dull, coriaceous, oblong, with a minute mucro, the outer usually sterile. Seeds light brown, about $\frac{1}{8}$ of an inch long, nearly encircled by a broad wing as wide as the body.

Winter characters—Branchlets arranged in flat, fan-shaped sprays, yellowish green, flattened, at first completely covered by the decussate, over-lapping leaves. During the second season, the laterals turn brown and fall with the leaves. The bark of the primary branches eventually becomes dark orange-brown and is marked by lateral branch-scars. Buds minute, without scales, protected by the appressed scale-like leaves. Mature bark light reddish brown, thin, fibrous, consisting of narrow anastomosing ridges separated by shallow fissures.

Habitat—In low swampy depressions and along stream sources, borders of ponds, streams and lakes where it often forms almost impenetrable, pure stands or grows in company with Spruce and Balsam, also on limestone 'outcroppings' where it makes more rapid growth and seeds better. Found on higher ground in the southern part of its range. A tolerant species.

Range—Nova Scotia to southeastern Manitoba, along the coast to New Jersey and in the mountains to North Carolina, westward through southwestern Pennsylvania, northern Ohio, n. Indiana, n. Illinois, and Wisconsin to central Minnesota.

Uses—Wood light, soft, brittle, aromatic, coarse-grained, straw-brown darkening with exposure, with thin, nearly white sapwood. Extremely durable in contact with the soil. Largely utilized for fence posts and poles. Arbor vitae is widely used as a hedge plant and otherwise ornamentally. Many varieties of abnormal habit have been developed which are usually propagated by 'cuttings.'



Southern White Cedar, White Cedar

Chamaecyparis thyoides (L.) B. S. P. [*Chamaecyparis sphaeroidea* Spach.; *Cupressus thyoides* L.]

1. A branch-tip with staminate flowers x 2
2. A stamen, front view x 8
3. A stamen, axile view x 8
4. A branch-tip with ovulate flowers x 2
5. Ovulate cone-scale, proximal side, showing ovules x 15
6. Ovulate cone-scale, distal side x 15
7. A fruiting spray showing mature cones x 1/2
8. Mature cone x 2
9. Winged seed x 5
10. Portion of twig showing phyllotaxy x 2 1/2

PINACEAE

Chamaecyparis thyoides (L.) B. S. P. [*Chamaecyparis sphaeroidea* Spach.; *Cupressus thyoides* L.]

Southern White Cedar, White Cedar

Habit—A tree usually 60—70 feet in height with a trunk diameter of 12—18 inches, under favorable conditions sometimes 80 feet in height. Crown narrowly conical, consisting of slender, horizontal branches with deciduous laterals, the latter commonly arranged in fan-shaped sprays.

Leaves—Opposite, keeled, often glandular, dark blue-green, dull. On normal twigs they are ovate, acuminate, appressed, imbricated, glandular, $\frac{1}{16}$ — $\frac{1}{8}$ of an inch long. The thrifty shoots have spreading, awl-shaped, often remote and eglandular leaves which are usually about $\frac{1}{8}$ of an inch long.

Flowers—Appearing in March and April, monoecious, borne in cones on different sprays. Staminate cones terminal, solitary, about $\frac{1}{8}$ of an inch long, oblong, 4-sided, consisting of 4—6 pairs of stamens with yellow pollen sacs. Ovulate flowers terminal, usually solitary, $\frac{1}{16}$ — $\frac{1}{8}$ of an inch long, subglobose, consisting of 6 peltate spreading scales, liver-colored at pollination.

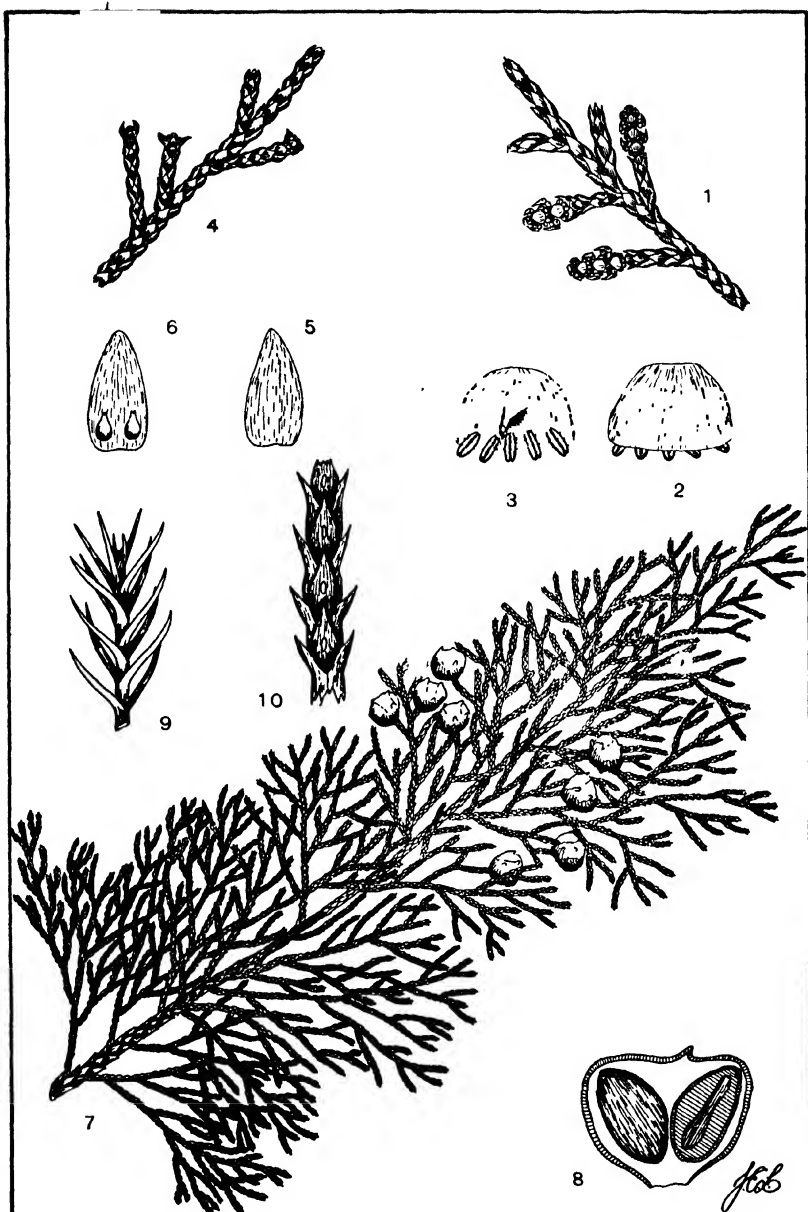
Fruit—A somewhat fleshy, globose, glaucous, nearly sessile, inconspicuous, bluish purple cone, about $\frac{1}{4}$ of an inch in diameter, turning dark reddish brown at the end of the first season, opening in the autumn and persisting on the sprays. Cone-scales peltate, the outer face marked by a slight projection. Seeds grayish brown, about $\frac{1}{8}$ of an inch long, with a dark brown wing as broad as the body.

Winter characters—Branchlets arranged in fan-shaped sprays which diverge at various angles, at first bluish green from the decussate, imbricated leaves, during the first winter becoming reddish brown, at length dark brown, slowly losing their leaves, marked by the scars of the deciduous laterals, and with small papery scales. Buds minute, without scales, protected by the appressed scale-like leaves. Mature bark light reddish brown, $\frac{3}{4}$ —1 inch thick, fibrous, consisting of narrow anastomosing ridges separated by shallow fissures.

Habitat—Thrives along the Atlantic and Gulf seaboard in cold, wet swamps which are inundated for long periods each year, forming pure stands or mixed with other swamp species including the gums, Red Maple, Black Ash, and Bald Cypress. Rare at higher elevations inland. A tolerant species.

Range—Extreme southern Maine and southeastern New Hampshire along the coast to central Florida and southeastern Mississippi, with isolated stations farther inland in southeastern New York and eastern Pennsylvania.

Uses—An important timber tree, especially in that it thrives in regions unsuitable for other species. Wood light, soft, weak, rather close-grained, slightly fragrant, light reddish or roseate brown with thin pale sapwood. Very durable in contact with the soil. Used for fence posts, poles, shingles, railroad ties, etc. The Coast White Cedar is one of the most beautiful of the eastern conifers and several ornamental varieties are recognized.



Eastern Red Cedar, Red Cedar

Juniperus virginiana L. (*Sabina virginiana* Ant)

1. A branch-tip with staminate flowers x $1\frac{1}{2}$
2. A stamen, front view x 10
3. A stamen, axile view x 10
4. A branch-tip with ovulate flowers x $1\frac{1}{2}$
5. Ovulate cone-scale, distal side x 10
6. Ovulate cone-scale, proximal side, showing ovules x 10
7. A fruiting spray showing mature berry-like cones x $\frac{1}{2}$
8. Section of cone showing mature seeds x $3\frac{1}{2}$
9. Tip of a vigorous shoot x $2\frac{1}{2}$
10. Portion of a normal branch showing phyllotaxy x $2\frac{1}{2}$

PINACEAE

Juniperus virginiana L. (*Sabina virginiana* Ant.)

Eastern Red Cedar, Red Cedar

Habit—At maturity a tree usually 40–50 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes attaining a height of 100 feet. Crown narrowly pyramidal, compact, deep, consisting of short, slender branches which are horizontal below and ascending above, in the open the branches often extending to the ground. In old age, the crown usually becomes broad and round-topped, and more or less irregular.

Leaves—Opposite, often glaucous, persisting 3–6 years. On normal shoots they are scale-like, 4-ranked, closely imbricated, ovate, acute (rarely obtuse), usually glandular on the back, dark bluish green, about $\frac{1}{8}$ of an inch long; those on vigorous shoots are linear-lanceolate, long-pointed, without glands, light yellowish green, $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long. The first type largely predominates.

Flowers—Appearing from February to May, dioecious (rarely monoecious), borne in cones. Staminate cones numerous, terminal, $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, oblong-ovate, consisting of 10–12 stamens, yellowish at maturity. Ovulate cones solitary, terminal, about $\frac{1}{8}$ of an inch long, ovoid, consisting of about 6 fleshy, spreading, acute, bluish scales, subtended by scale-like bracts.

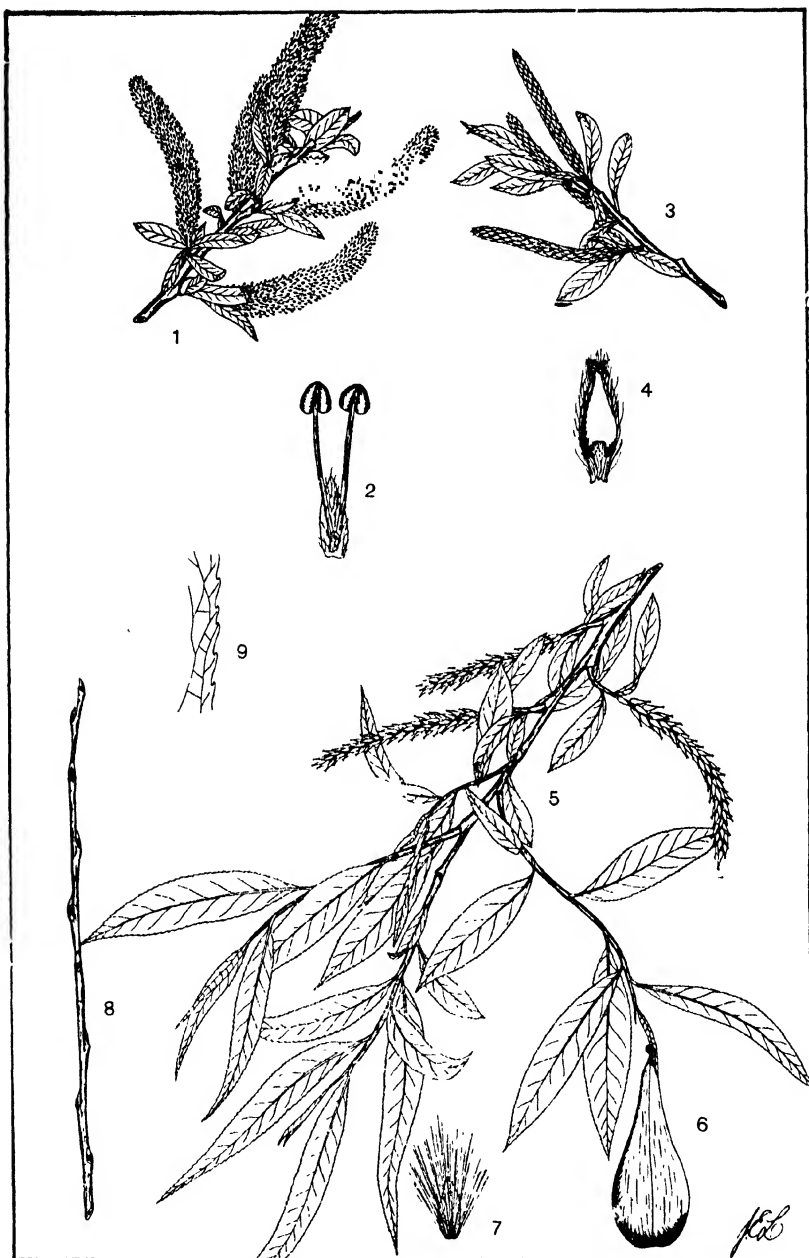
Fruit—A subglobose, pale green, somewhat angled, berry-like cone, $\frac{1}{4}$ – $\frac{1}{2}$ of an inch in diameter, becoming dark blue and glaucous in the autumn, with firm epidermis and thin sweet flesh. Cone-scales fleshy, coherent. Seeds 1–2, light chestnut-brown, lustrous, wingless, $\frac{1}{16}$ – $\frac{1}{8}$ of an inch long, requiring 2–3 years to germinate.

Winter characters—Branchlets slender, 4-sided, at first green with the appressed leaves, when older round and dark reddish brown. Buds minute, inconspicuous, covered by the appressed, imbricated leaves. Mature bark reddish brown, thin, somewhat grooved, persisting many years, peeling off at length in long, narrow, fibrous strips.

Habitat—A gregarious species thriving on a wide variety of sites and soils including abandoned fields, rocky cliffs, limestone outcroppings, swamps, and bottom-lands. Attains its best development on the alluvial soils of the southern states. Widely spread by birds who eat the fleshy cone.

Range—Along the coast from southern Nova Scotia to central Georgia, southern Alabama, and Mississippi, west through Ontario and southern Michigan to southeastern North Dakota, south to eastern Texas.

Uses—A valuable commercial species. Wood light, soft, fragrant, brittle, extremely durable in contact with the soil, readily worked, rosy-red when first exposed, at length dull red, with thin, nearly white sapwood. Formerly largely used in the manufacture of lead pencils. Now utilized for moth-proof chests, cabinet-making, interior finish, fence posts, etc. The tree is likewise grown extensively as an ornamental, numerous varieties being recognized.



Golden Willow

Salix alba var. *vitellina* Stokes. [*Salix vitellina* L.]

1. A twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 5$
3. A twig showing pistillate aments $\times \frac{1}{2}$
4. Pistillate flower, proximal view $\times 5$
5. A twig showing mature leaves and fruiting aments $\times \frac{1}{2}$
6. Mature capsule $\times 4$
7. Comose seed $\times 4$
8. Winter twig $\times \frac{1}{2}$
9. Portion of leaf-margin, enlarged

SALICACEAE

Salix alba var. *vitellina* Stokes* [*Salix vitellina* L.]

Golden Willow

Habit—A large tree, under favorable conditions sometimes becoming 70—100 feet in height with a trunk diameter of 3—6 feet. Bole short, stout, irregular, dividing near the ground into several large, obliquely ascending branches which form a somewhat irregular, broad and rounded crown.

Leaves—Alternate, short-petioled, narrow-lanceolate, $1\frac{1}{2}$ —4 inches long, $\frac{1}{3}$ — $\frac{2}{3}$ of an inch wide, long-acuminate at the apex, wedge-shaped at the base, serrulate, at maturity dark green and glabrous or slightly hairy above, glaucous and slightly silky beneath. Stipules lanceolate, fugacious.

Flowers—Appearing in April or May. dioecious, glandular, borne in the axils of yellow, narrowly ovate bracts, the whole forming aments terminal on short, leafy branchlets. Staminate aments oblong-cylindrical, densely flowered, 1—2 $\frac{1}{2}$ inches long, yellowish. Pistillate aments linear-cylindrical and whitish at maturity. Stamens 2, with long filaments villous at the base and yellow anthers. Pistil solitary, consisting of a smooth, short-pedicellate, conic-ovoid ovary and 2 nearly sessile stigmas.

Fruit—A brownish, nearly sessile, smooth, ovoid-conic capsule, about $\frac{1}{4}$ of an inch long, opening by 2 opposite sutures to set free the minute comose seeds.

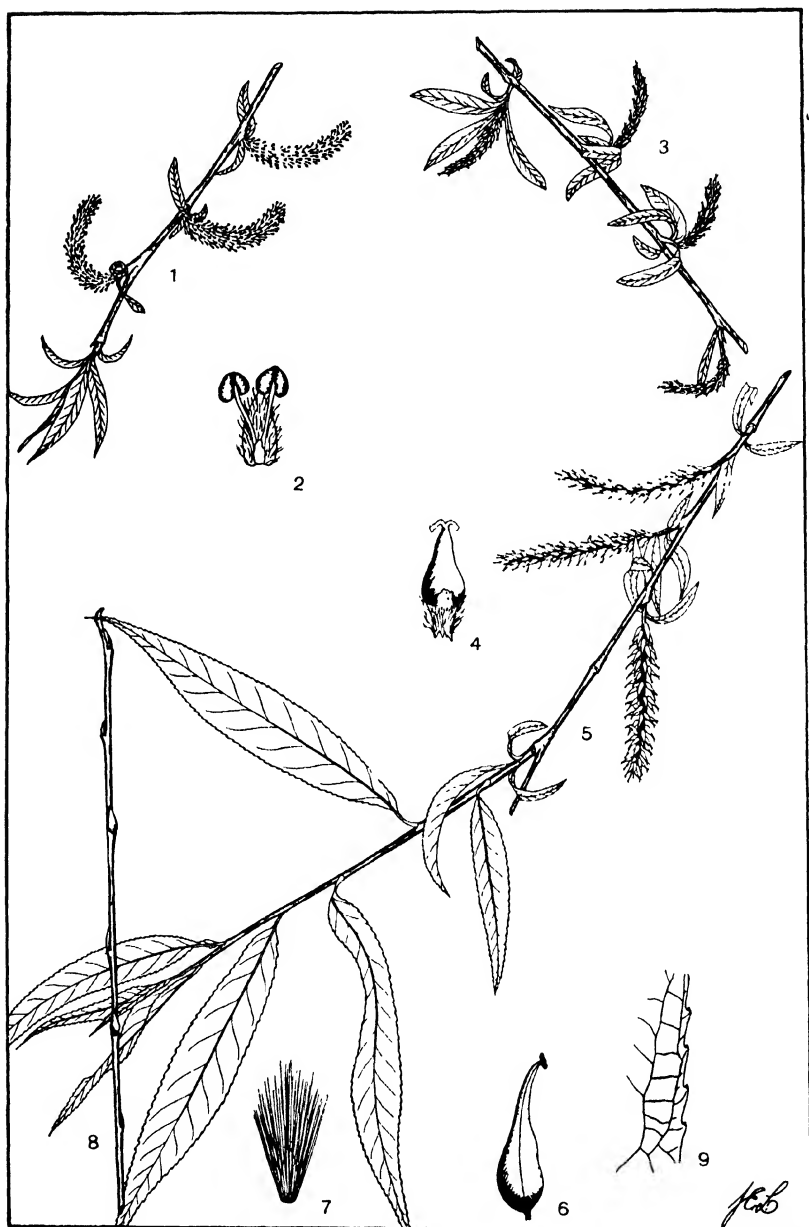
Winter characters—Twigs slender, rather brittle at the base, finely hairy at first, at length smooth and lustrous, bright yellow, becoming yellowish brown. Terminal bud lacking. Lateral buds 1-scaled, oblong to ovoid, rounded at the apex, closely appressed, greenish yellow. Mature bark dark gray, deeply furrowed, with prominent, scaly ridges.

Habitat—Typically found along stream courses where there is abundant moisture, spreading by suckers and 'natural cuttings', rarely through seeds. Thrives well on moist uplands.

Range—A species originally introduced from Europe for shade and ornament, now widely naturalized in eastern North America.

Uses—Of value chiefly as a shade and ornamental tree. Sometimes planted along water courses to prevent erosion as it is readily propagated by cuttings and grows rapidly. Wood light, soft, close-grained, tough, light brown with thick, nearly white sapwood. Used occasionally for light fuel and charcoal.

*Var. *vitellina* Stokes of the White Willow (*Salix alba* L.) is apparently much more common in the Northeast than the straight species and hence is described above. *Salix alba* L. possesses somewhat broader leaves which are more silky and permanently silky beneath, shorter aments with shorter bracts, and greenish twigs.



Weeping Willow

Salix babylonica L.

1. A twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 5$
3. A twig showing pistillate aments $\times \frac{1}{2}$
4. A pistillate flower, proximal view $\times 5$
5. A pendent twig showing mature leaves and aments $\times \frac{1}{2}$
6. Mature capsule $\times 10$
7. Comose seed $\times 10$
8. Winter twig $\times \frac{1}{2}$
9. Portion of leaf-margin, enlarged.

SALICACEAE
***Salix babylonica* L.**

Weeping Willow*

Habit—A tree of characteristic habit, at maturity sometimes attaining a height of 60—75 feet with a short, stout trunk 2—6 feet in diameter. Crown broad, globose to globose-oblong, consisting of arching limbs which bear long, pendent, leafy twigs, giving the tree a very bizarre appearance.

Leaves—Alternate, petioled, pendent, linear-lanceolate to lanceolate, 3—6 inches long, $\frac{3}{4}$ — $\frac{1}{2}$ of an inch wide, long-acuminate at the apex, cuneate at the base, serrulate, at maturity dark green and glabrous above, grayish green beneath. Stipules small, ovate-lanceolate, fugacious.

Flowers—Appearing with the leaves in April and May, dioecious, glandular, borne in the axils of ovate-lanceolate, greenish yellow bracts, the whole forming aments terminal on short, leafy, lateral branches. Staminate aments elongate-cylindrical, densely flowered and usually curved, yellowish, $\frac{1}{2}$ — $1\frac{1}{2}$ inches long. Pistillate aments linear-cylindrical and greenish at maturity, shorter than the staminate. Stamens 2, with rather short, smooth filaments and yellow anthers. Pistil solitary, consisting of an ovate, sessile or nearly sessile, smooth ovary, a short style, and 2 spreading stigmas.

Fruit—A smooth, beaked, ovate, pale brown capsule, about $\frac{1}{2}$ of an inch long, opening by 2 sutures at maturity to set free the minute, comose seeds.

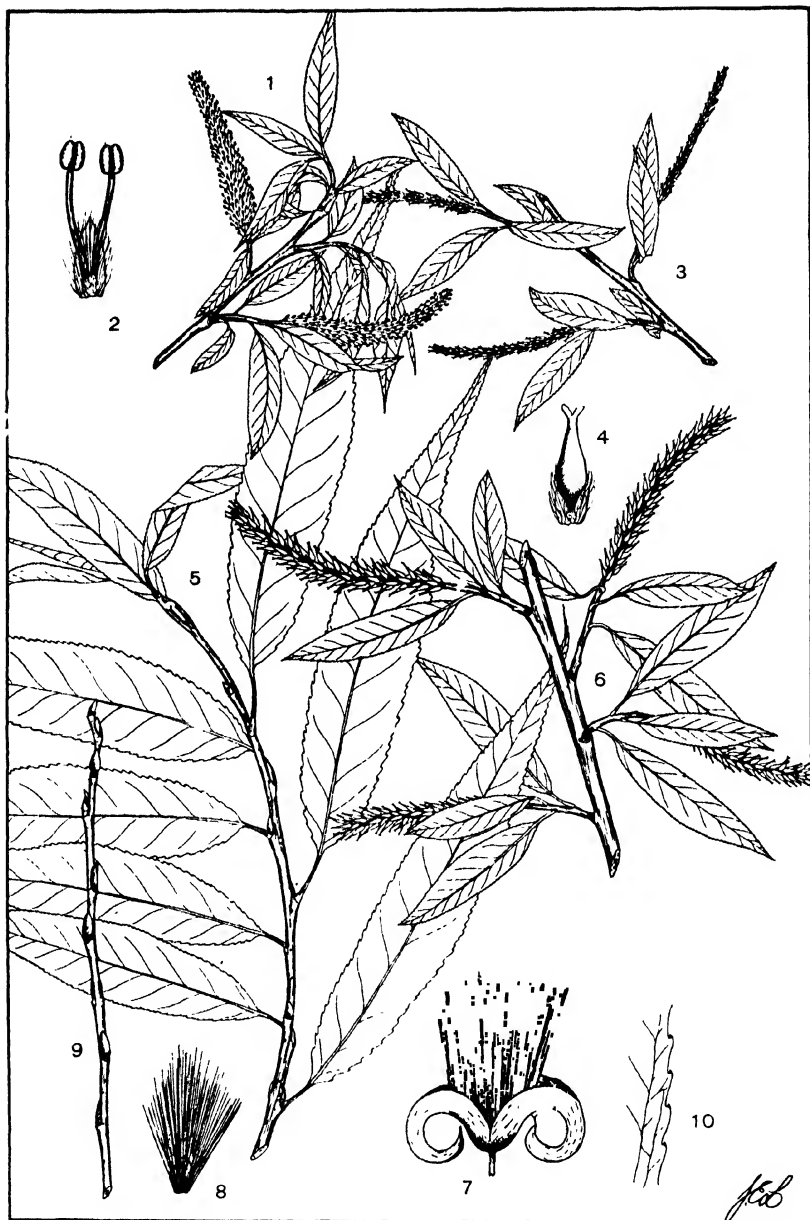
Winter characters—Twigs slender, yellowish green to brown, smooth, somewhat lustrous, drooping. Terminal bud lacking. Lateral buds 1-scaled, oblong-ovate, acute, appressed, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark gray, rather smooth, shallowly and reticulately ridged.

Habitat—A moisture-loving species thriving along streams, about lakes and ponds or on sites where the water table is close to the surface.

Range—Originally a native of northern China, in spite of its name, ***babylonica***, pertaining to Babylon. Now widely cultivated in Europe, and in North and South America. Becoming established occasionally through 'natural cuttings', the twigs falling upon the surface of the water, floating away, and eventually taking root elsewhere.

Uses—Widely used for ornament and shade, especially about artificial ponds and lakes in city and suburban parks. Of no significance in this country from the standpoint of lumber. A variety, var. ***crispa***, is recognized.

**Salix blanda* Anders., a closely allied species, is sometimes confused with Weeping Willow but is probably not naturalized. It differs from *Salix babylonica* in possessing broader, lanceolate leaves and a stalked ovary.



Crack Willow, Brittle Willow

Salix fragilis L.

- | | |
|--|---|
| 1. A twig showing staminate aments x $\frac{1}{2}$ | 5. A twig with mature leaves x $\frac{1}{2}$ |
| 2. A staminate flower, proximal view x 5 | 6. Portion of twig showing mature aments x $\frac{1}{2}$ |
| 3. A twig showing pistillate aments x $\frac{1}{2}$ | 7. Mature capsule x 4 |
| 4. A pistillate flower, proximal view x 5 | 8. Comose seed x 4 |
| | 9. Winter twig x $\frac{1}{2}$ |
| | 10. Portion of leaf-margin, enlarged |

SALICACEAE

Salix fragilis L.

Crack Willow, Brittle Willow

Habit—A large tree sometimes attaining a height of 60—80 feet with a trunk diameter of 3—4 feet. Crown wide and rounded, consisting of upright and ascending, wide-spreading branches.

Leaves—Alternate, petioled, oblong-lanceolate to narrow-lanceolate, 3—6 inches long, $\frac{3}{4}$ — $1\frac{1}{2}$ inches wide, long-acuminate at the apex, cuneate at the base, finely glandular serrate, at maturity coriaceous, dark green and glabrous above, paler and somewhat glaucous below, borne on glandular petioles $\frac{1}{4}$ —1 inch long. Stipules semi-cordate, serrate.

Flowers—Appearing in April and May, dioecious, glandular, borne in the axils of ovate, rather blunt and hairy, persistent scales, the whole forming densely-flowered aments terminal on short, leafy branchlets. Staminate aments narrowly oblong to conic, $\frac{1}{2}$ — $1\frac{1}{2}$ inches long. Pistillate aments linear-cylindrical, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long. Stamens 2, with free, smooth filaments and yellow anthers. Pistil solitary, consisting of a smooth, conic-ovoid, short-stalked ovary, a short style, and 2 spreading stigmas.

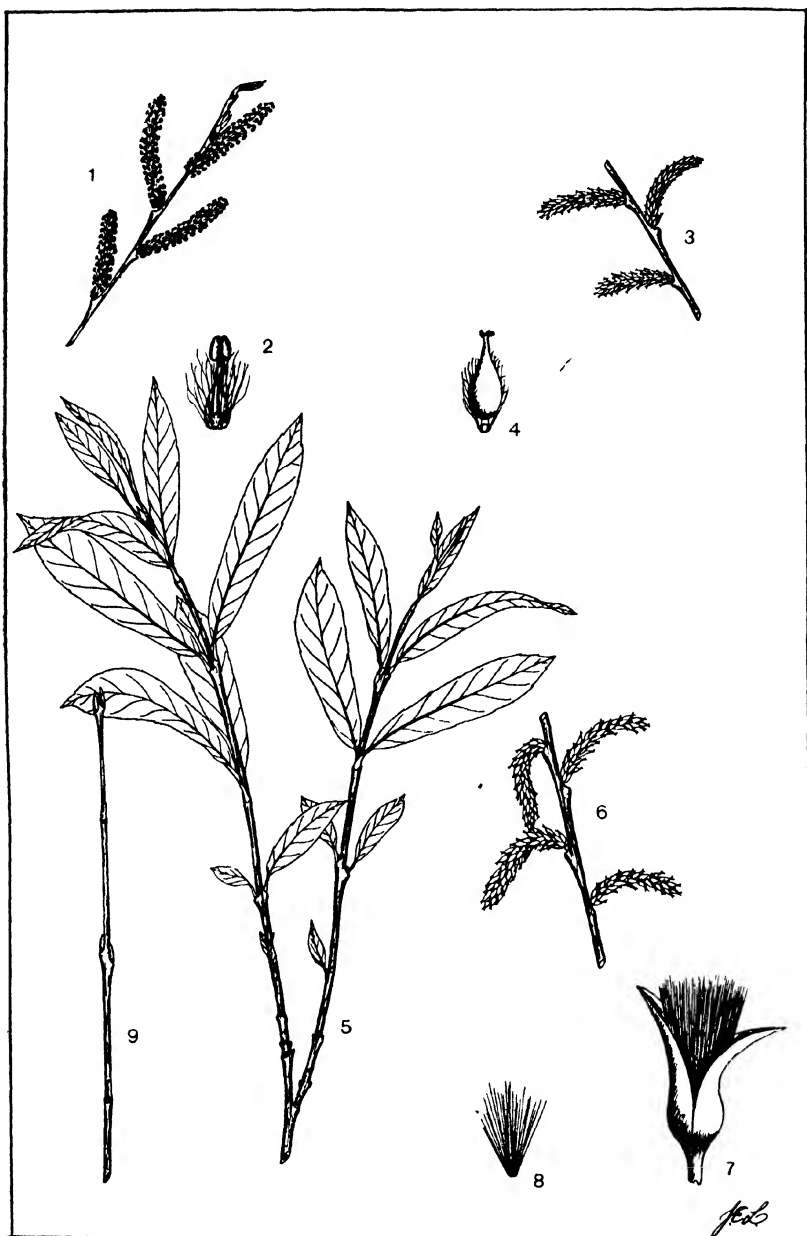
Fruit—A short-pedicellate, glabrous, long-conical capsule, about $\frac{1}{2}$ of an inch long, opening at maturity by 2 opposite sutures to set free the minute, comose seeds.

Winter characters—Twigs somewhat angular, slender, at first reddish to yellowish brown and finely hairy, finally lustrous brown and smooth, lenticellate, with raised leaf-scars, very brittle at the base. Terminal bud lacking. Lateral buds 1-scaled, oblong-ovate, bluntly acute, and smooth, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark gray or grayish brown, thick, with narrow, scaly, anastomosing ridges separated by rather broad furrows.

Habitat—More cosmopolitan in distribution than Weeping Willow, thriving well on deep, moist, upland soils as well as along stream courses, margins of ponds, etc.

Range—A native of Europe and Asia, long cultivated in this country for ornament and shade. Naturalized in the eastern states and Canada, spreading by 'natural cuttings' as well as by seed. Common along our streams and rivers, the brittle twigs snapping off with a cracking sound, falling, and eventually taking root.

Uses—Of no commercial significance in this country aside for ornament and shade. Occasionally used for light fuel and charcoal. In the Old World, the trees are pollarded where fuel is scarce or are sometimes sawed into lumber.



Purple Willow, Purple Osier

Salix purpurea L.

- | | |
|--|---|
| 1. A twig showing staminate aments x $\frac{1}{2}$ | 5. A twig with mature leaves x $\frac{1}{2}$ |
| 2. A staminate flower, proximal view x 5 | 6. Portion of a twig showing fruiting aments x $\frac{1}{2}$ |
| 3. A twig showing pistillate aments x $\frac{1}{2}$ | 7. Mature capsule x 10 |
| 4. A pistillate flower, proximal view x 5 | 8. Comose seed x 10 |
| | 9. Winter twig x $\frac{1}{2}$ |

SALICACEAE
***Salix purpurea* L.**

Purple Willow, Purple Osier

Habit—Usually a shrub, occasionally a small tree 25—30 feet in height with a rather broad, rounded crown and short, irregular trunk 5—8 inches through. Branches ascending, bearing long, slender, flexuous and somewhat pendulous twigs.

Leaves—Alternate or often subopposite, short-petioled, oblanceolate or rarely oblong-obovate, 2—4 inches long, $\frac{1}{4}$ — $\frac{1}{2}$ wide, acute or acuminate at the apex, cuneate or rounded at the base, entire or slightly serrulate toward the apex, at maturity smooth and dark dull green above, pale or glaucous beneath, turning black in drying. Stipules small, fugacious.

Flowers—Appearing in April and May, dioecious, glandular, borne in the axils of obovate, blunt, hairy, purplish, persistent bracts, the whole forming densely-flowered, narrow-cylindrical, nearly sessile aments which measure $\frac{3}{4}$ —1 inch in length and appear before the leaves on twigs of the preceding season. Stamen 1, with free, smooth filament and orange or reddish yellow anther. Pistil solitary, consisting of a grayish-tomentose, ovoid, sessile or subsessile ovary, a short style, and 2 small stigmas.

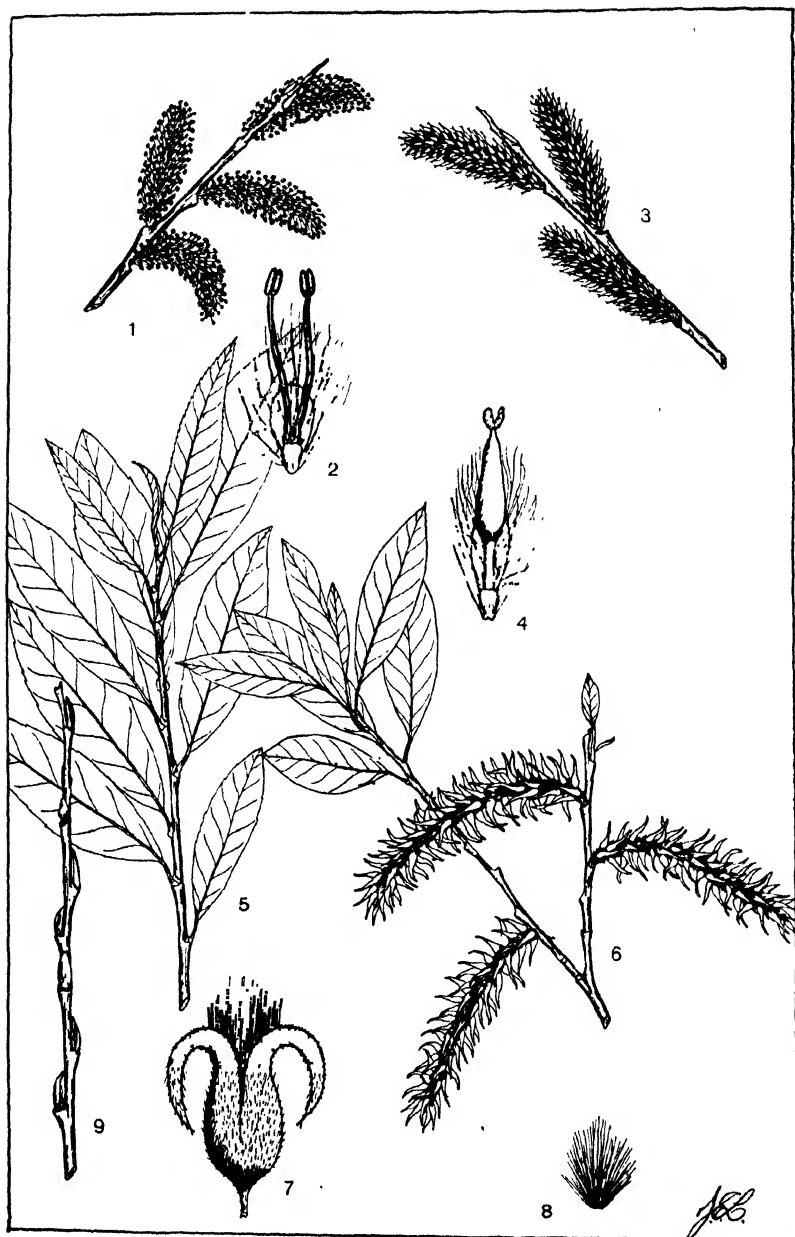
Fruit—A sessile, grayish tomentose, ovoid, obtuse capsule, $\frac{1}{2}$ — $\frac{3}{8}$ of an inch long, enclosing minute, comose seeds.

Winter characters—Twigs long, slender, flexuous, glabrous, purplish, sometimes glaucous, lenticellate, with raised leaf-scars. Terminal bud lacking. Lateral buds alternate or subopposite, ovate-oblong, acute, smooth, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark grayish black, shallowly fissured and narrowly ridged, the ridges scaly at the surface.

Habitat—Grown extensively for wickerware on low, wet, alluvial soils. A water-loving species requiring a moist but not necessarily a wet soil. Native to the Old World from Europe and North Africa to Central Asia and Japan.

Range—Cultivated at Liverpool, N. Y., and elsewhere in the East for wickerware. An occasional 'escape' throughout the eastern and central states, usually on low ground.

Uses—An important osier-willow, thriving well in the Northeast. This species can be grown profitably on low, wet farm meadows which are unsuited for other crops. Occasionally used as an ornamental.



Pussy Willow, Glaucous Willow

Salix discolor Muhl.

1. A twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 5$
3. A twig showing pistillate aments $\times \frac{1}{2}$
4. A pistillate flower, proximal view $\times 5$
5. A twig with mature leaves $\times \frac{1}{2}$
6. A twig showing leaves and fruiting aments $\times \frac{1}{2}$
7. Mature capsule $\times 5$
8. Comose seed $\times 10$
9. Winter twig $\times \frac{1}{2}$

SALICACEAE
Salix discolor Muhl.

Pussy Willow, Glaucous Willow

Habit—Usually shrubby with many ascending branches, occasionally a small tree 15—25 feet in height with a short bole 5—8 inches in diameter. Crown round-topped, consisting of stout, ascending branches and twigs.

Leaves—Alternate, petioled, in the typical form elliptic-oblong to oblong-ob lanceolate $1\frac{1}{2}$ —4 inches long, $\frac{3}{4}$ —1 inch wide, acute at the apex, cuneate at the base, irregularly crenate-serrate or nearly entire, at maturity rather thin and subcoriaceous, bright green and glabrous above, pale white-glaucous beneath. Stipules usually conspicuous, semi-cordate, fugacious. Leaves very variable in size and form, running into several varieties, of which var. **eriocephala** (Michx.) Anders.* is the best known.

Flowers—The first of the willows to blossom in the spring, the flower buds beginning to open in March and April. Flowers dioecious, glandular, borne in the axils of oblong-obovate, reddish brown, densely white hairy scales, the whole forming stout, nearly sessile, oblong-cylindrical aments about 1 inch long which appear before the leaves from axillary buds along the stout twigs. Stamens 2, with elongated, smooth filaments and yellow anthers. Pistil solitary, consisting of a villous, oblong-cylindrical, attenuated, long-stalked ovary and a short style with spreading, entire stigmas.

Fruit—A large, pale pubescent, long-beaked, stalked, light brown capsule, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, opening at maturity by 2 opposite sutures to set free the minute, comose seeds. Pistillate ament up to $2\frac{1}{2}$ inches in length in fruit.

Winter characters—Twigs stout, lenticellate, terete, at first somewhat pubescent, at length dull reddish purple and glabrous. Terminal bud lacking. Lateral buds 1-scaled, ovate, flattened and acute at the apex, dark reddish purple and lustrous, about $\frac{3}{8}$ of an inch long. Mature bark thin, light brown tinged with red, divided by shallow fissures into thin, oblong, deciduous scales.

Habitat—Wet marshy sites along stream courses and lakes, hanging bogs, spring holes, and low meadows.

Range—Nova Scotia to Manitoba, Maine to northeastern North Dakota, south to Delaware, Kentucky and northeastern Missouri.

Uses—Of little commercial significance. The aments are showy before blossom-time and are frequently collected as harbingers of spring.

*Var. **eriocephala** differs from the straight species in possessing pubescent twigs, leaves which are pubescent beneath, and smaller aments.



Beak Willow, Bebb Willow

Salix bebbiana Sarg. [*Salix rostrata* Rich.]

- | | |
|--|---|
| 1. A twig showing staminate aments x $\frac{1}{2}$ | 6. A twig showing leaves and fruit- ing aments x $\frac{1}{2}$ |
| 2. A staminate flower, proximal view x 5 | 7. Mature capsule x 4 |
| 3. A twig showing pistillate aments x $\frac{1}{2}$ | 8. Comose seed x 8 |
| 4. A pistillate flower, proximal view x 5 | 9. Winter twig x $\frac{1}{2}$ |
| 5. A twig with mature leaves x $\frac{1}{2}$ | |

SALICACEAE

Salix bebbiana Sarg. [*Salix rostrata* Rich.]

Beak Willow, Bebb Willow

Habit—Usually shrubby and 6—10 feet in height, occasionally a small bushy tree 20—25 feet high with a short, often oblique and twisted trunk 5—8 inches in diameter. Crown broad and rounded.

Leaves—Alternate, short-petioled, obovate to elliptic-lanceolate, 1—3 inches long, $\frac{1}{2}$ —1 inch wide, acute or acuminate at the apex, cuneate or rounded at the base, remotely serrate or entire, at maturity thick, dull green, puberulous and rugose-veined above, pale green or grayish pubescent beneath. Stipules semi-cordate, fugacious.

Flowers—Appearing in April and May, dioecious, glandular, borne in the axils of oblong, rounded, rose-tipped scales, the whole forming aments terminal on short leafy branchlets. Staminate aments cylindrical-obovate, densely flowered, $\frac{3}{4}$ —1 $\frac{1}{2}$ inches long. Pistillate aments oblong-cylindrical, loosely flowered, up to 2 $\frac{1}{2}$ inches in length. Stamens 2, with free, smooth filaments. Pistil solitary, consisting of a gray-pubescent, narrowly ovoid, stalked ovary prolonged into a slender beak, and 2 broad, sessile stigmas.

Fruit—A gray-pubescent, ovoid, beaked, long-pedicellate capsule, $\frac{1}{4}$ — $\frac{5}{8}$ of an inch long, opening at maturity by 2 opposite sutures to set free the minute, comose seeds.

Winter characters—Twigs slender, at first hairy, during the first winter smooth, purplish to brown, lenticellate, with elevated leaf-scars. Terminal bud lacking. Lateral buds 1-scaled, oblong, rounded at the apex, closely appressed, chestnut-brown, about $\frac{1}{4}$ of an inch long. Mature bark reddish green to grayish, smooth or shallowly furrowed.

Habitat—Has a wider range of habitat than most willows, occurring in swamps, along borders of streams and lakes, likewise on drier upland sites on open hillsides, slashes and burns, often on comparatively dry soil.

Range—A widely distributed species ranging from Newfoundland to Alaska, south in the United States to New Jersey, Pennsylvania and Iowa, southwest through Colorado to Arizona.

Uses—Of no economic importance.



Peach-leaved Willow, Almond-leaved Willow

Salix amygdaloides Anders.

- | | |
|--|--|
| 1. A twig showing staminate aments x $\frac{1}{2}$ | 5. A branch showing mature leaves and fruiting aments x $\frac{1}{2}$ |
| 2. A staminate flower, proximal view x 5 | 6. Mature capsule x 4 |
| 3. A twig showing pistillate aments x $\frac{1}{2}$ | 7. Comose seed x 4 |
| 4. A pistillate flower, proximal view x $\frac{1}{2}$ | 8. Winter twig x $\frac{1}{2}$ |
| | 9. Portion of leaf-margin, enlarged |

SALICACEAE
***Salix amygdaloides* Anders.**

Peach-leaved Willow, Almond-leaved Willow

Habit—A tree under optimum conditions occasionally 60—70 feet in height with a trunk diameter of 1—2 feet and a single, columnar bole, usually much smaller. Crown rather narrow, rounded, consisting of ascending, spreading branches.

Leaves—Alternate, ovate-lanceolate to lanceolate, $2\frac{1}{2}$ —4 inches long, $\frac{3}{4}$ —1 inch wide, attenuate-cuspidate at the apex, wedge-shaped or somewhat rounded at the base, finely serrate, at maturity thin, firm, light green and lustrous above, pale glaucous below, borne on long, usually twisted petioles which diverge nearly at right angles to the twig. Stipules minute, fugacious.

Flowers—Appearing in May with the leaves, terminal on short, lateral, leafy branchlets, dioecious, glandular, in the axils of yellow, broadly ovate scales, the whole forming an elongated, cylindrical, more or less erect, hairy ament 2—3 inches in length. Perianth wanting. Stamens 5—9, with long filaments and yellow anthers. Pistil solitary, consisting of an oblong-conical, glabrous, long-stalked, 1-celled ovary, a short style, and 2 spreading stigmas.

Fruit—A pale reddish yellow, globose-conical, pedicellate capsule, about $\frac{1}{4}$ of an inch long, opening by 2 sutures at maturity to set free the minute, comose seeds.

Winter characters—Twigs slender, smooth, pale lenticellate, not brittle at the base, orange or reddish brown. Terminal bud lacking. Lateral buds brown and lustrous, 1-scaled, rather blunt, ovoid, about $\frac{1}{8}$ of an inch long. Mature bark brown, thick, irregularly furrowed and scaly ridged.

Habitat—Typically found along the banks of streams, rivers, lake shores, and on wet bottom-lands, rarely on dry gravelly and sandy soils.

Range—Western Quebec through southern Canada to British Columbia, south to central New York, westward to the Rocky Mountains, in the Rockies from Oregon to northwestern Texas.

Uses—Produces a soft, weak, close-grained, inferior wood. Heartwood light brown; sapwood white, rather thick. Occasionally manufactured into cheap lumber. Used locally for fuel and occasionally for charcoal.



Black Willow, Crack Willow

Salix nigra Marsh.

1. A twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 5$
3. A twig showing pistillate aments $\times \frac{1}{2}$
4. A pistillate flower, proximal view $\times 5$
5. A winter twig showing leaves and fruiting ament $\times \frac{1}{2}$
6. A branch showing leaves and fruiting aments $\times \frac{1}{2}$
7. Mature capsule $\times 5$
8. Comose seed $\times 5$
9. Portion of leaf-margin, enlarged
10. Winter twig $\times \frac{1}{2}$

SALICACEAE
Salix nigra* Marsh.

Black Willow, Crack Willow

Habit—A short-lived tree of rapid growth which attains maturity in 50—70 years, generally 30—40 feet high with a trunk up to 1 foot in diameter, frequently with several crooked, medium-sized trunks ascending obliquely from the same root crown. Crown broad and open, consisting of stout, ascending branches and drooping branchlets. The southern variety, *Salix nigra* var. *altissima* Sarg., sometimes attains a height of 120 feet which is the maximum for any American Willow.

Leaves—Alternate, lanceolate, 2—6 inches long, $\frac{1}{8}$ — $\frac{3}{4}$ of an inch wide, long-attenuate and usually curved at the apex, rounded or wedge-shaped at the base, finely serrate, at maturity thin, light green, smooth and lustrous above, pale green and glabrous (except on the veins) beneath, borne on short petioles. Stipules on vigorous shoots foliaceous, semi-cordate and persistent, on normal shoots minute, ovoid, and deciduous.

Flowers—Appearing in May, terminal on short, lateral, leafy branchlets, dioecious, glandular, borne in the axils of yellow, rounded scales, the whole forming narrow, cylindrical aments 1—3 inches in length. Perianth wanting. Stamens 3—5, with long filaments and yellow anthers. Pistil solitary, consisting of a stalked, glabrous, ovate, 1-celled ovary and 2 nearly sessile, thick stigmas.

Fruit—A reddish brown, ovate, smooth, short-pedicellate capsule, about $\frac{1}{4}$ of an inch long, opening by 2 sutures at maturity to set free the minute, comose seeds.

Winter characters—Twigs slender, smooth, very brittle at the base, reddish brown to pale orange. Terminal bud lacking. Lateral buds 1-scaled, acute, reddish brown, about $\frac{1}{8}$ of an inch long. Mature bark varying from brown to nearly black, thick, divided by deep furrows into broad, flat, anastomosing ridges which are scaly at the surface.

Habitat—A moisture-loving species growing on wet sites along stream courses, shores of lakes, flat swampy areas, more rarely in upland situations. Propagates readily through 'natural cuttings', sprouts, and root suckers.

Range—Nova Scotia to Minnesota, south to Georgia, central Alabama, and western Texas.

Uses—Of little value in the North as a source of lumber. The southern variety produces a cheap grade of lumber in the Lower Mississippi Basin. Wood light, soft, weak, fine grained, pale reddish brown with nearly white sapwood. Made into artificial limbs, slack cooperage, excelsior, charcoal, pulp, and cheap furniture. Because of the ease of propagation by cuttings and its rapid growth, this species is used extensively in bank-revetment along streams.

**Salix nigra* var. *falcata* (Pursh.) Torr. is also frequent in the northeastern portion of the range of *Salix nigra* Marsh.; this has narrower, scythe-shaped leaves.



Shining Willow

Salix lucida Muhl.

1. A twig showing staminate aments
x 1
2. A staminate flower, proximal view
x 5
3. A twig showing pistillate aments
x 1
4. A pistillate flower, proximal view
x 5
5. A twig showing mature leaves and
fruiting aments x $\frac{1}{2}$
6. Mature capsule x 4
7. Cornose seed x 5
8. Winter twig x $\frac{1}{2}$
9. Portion of leaf-margin, enlarged

SALICACEAE
***Salix lucida* Muhl.**

Shining Willow

Habit—Usually shrubby, occasionally a small bushy tree 20—30 feet in height with a trunk-diameter of 6—8 inches. Crown round-topped, symmetrical, rather broad. Trunk short.

Leaves—Alternate, lanceolate to ovate-lanceolate, 3—5 inches long, 1—1½ inches wide, long-attenuate at the apex, wedge-shaped or rounded at the base, finely glandular-serrulate, at maturity coriaceous, dark green and lustrous above, paler and lustrous beneath, borne on short, terete, glandular petioles. Stipules semi-cordate, very glandular, usually persistent through the summer.

Flowers—Appearing in May and early June, dioecious, glandular, borne in the axils of yellowish, rounded scales, the whole forming aments terminating short leafy branches. Staminate aments oblong-cylindrical, densely flowered, 1—2½ inches long. Pistillate aments slender-cylindrical, 1½—3 inches long. Perianth wanting. Stamens 5, with long filaments which are hoary below, and yellow anthers. Pistil solitary, consisting of a stalked, glabrous, conic-ovoid ovary and 2 nearly sessile stigmas.

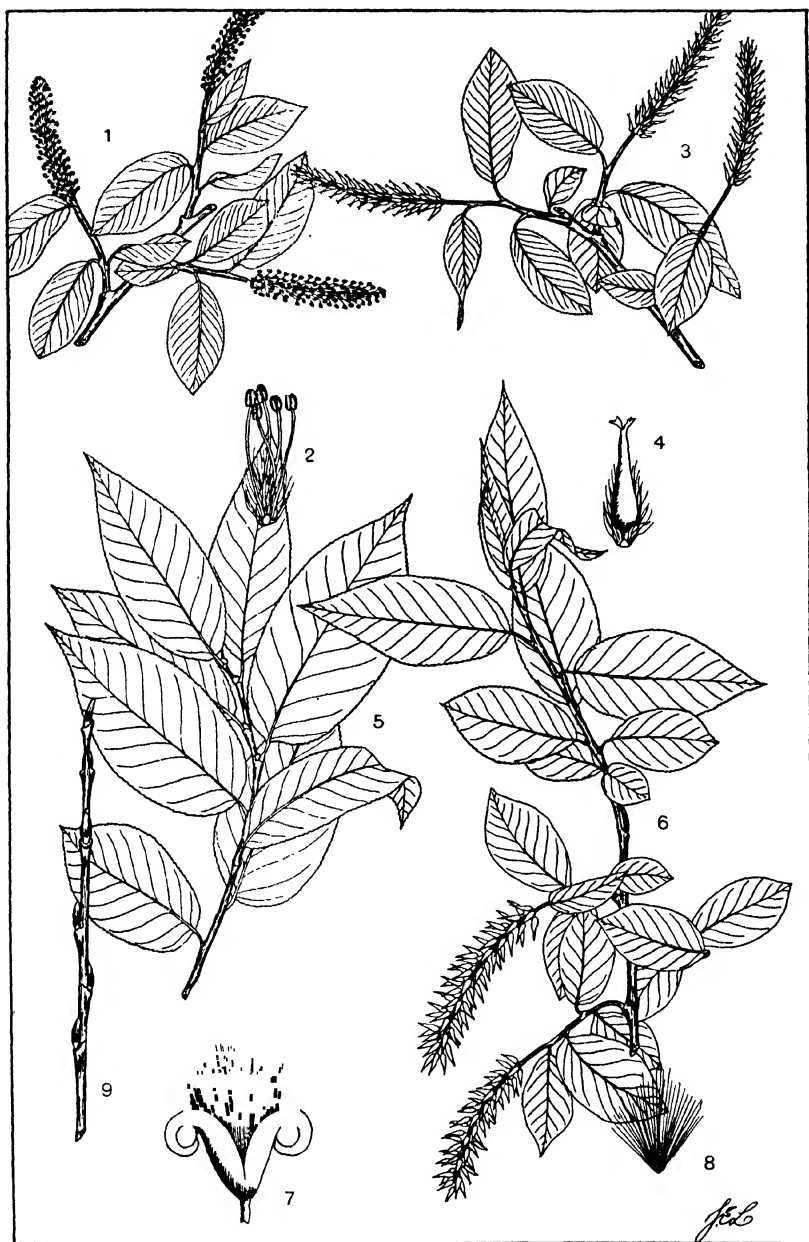
Fruit—A pale brown, smooth and lustrous, conic-ovoid capsule, about ½ of an inch long, opening by 2 opposite sutures at maturity to set free the minute, comose seeds.

Winter characters—Twigs stout, glabrous, dark yellowish brown, at length dark brown. Terminal bud lacking. Lateral buds 1-scaled, oval, acute, yellowish brown and lustrous, about ¼ of an inch long. Mature bark reddish brown, thin, divided into furrows and flat-topped, shallow ridges.

Habitat—A moisture-loving species occurring in swamps, along stream courses and lake shores, and in springy places.

Range—Newfoundland westward through the North West Territories in Canada, in the United States from Maine to New Jersey, westward through southern Pennsylvania and Kentucky to Nebraska.

Uses—Of slight economic importance. The tree deserves consideration ornamentally because of its dark green, shining foliage which resembles that of the Bay-leaved Willow.



Bay-leaved Willow, Laurel-leaved Willow

Salix pentandra L. [*Salix laurifolia* Wesm.]

1. A twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 4$
3. A twig showing pistillate aments $\times \frac{1}{2}$
4. A pistillate flower, proximal view $\times 4$
5. A twig showing mature leaves $\times \frac{1}{2}$
6. A twig showing leaves and fruiting aments $\times \frac{1}{2}$
7. Mature capsule $\times 3$
8. Comose seed $\times 3$
9. Winter twig $\times \frac{1}{2}$

SALICACEAE

Salix pentandra L. [*Salix laurifolia* Wesm.]

Bay-leaved Willow, Laurel-leaved Willow

Habit—A small tree, 25—40 feet high with a trunk diameter of 5—10 inches, rarely reaching 65 feet, often shrubby. Crown round-topped, symmetrical, consisting of wide-spreading branches, the lower somewhat pendulous. Bole short, stout, dividing above into several large, obliquely ascending limbs.

Leaves—Alternate, elliptic or ovate to elliptic-lanceolate, $1\frac{1}{2}$ — $4\frac{1}{2}$ inches long, $\frac{1}{4}$ — $\frac{1}{2}$ inches wide, short-acuminate at the apex, rounded at the base, finely glandular serrate, at maturity coriaceous, dark green and very lustrous above, green and paler below, borne on short glandular petioles. Stipules broadly ovate to semi-circular, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long, fugacious except on vigorous shoots.

Flowers—Appearing in April and May, dioecious, glandular, borne in the axils of hairy, narrowly ovate scales, the whole forming rather loosely flowered aments which are borne terminally on short leafy branchlets. Staminate aments narrow-cylindrical, 1—2 inches long. Pistillate aments similar but slightly longer. Stamens 5, with long, free, smooth filaments and small anthers. Pistil solitary, consisting of a smooth, narrowly ovoid ovary which is rounded and stalked at the base, a short style, and 2 nearly sessile, spreading stigmas.

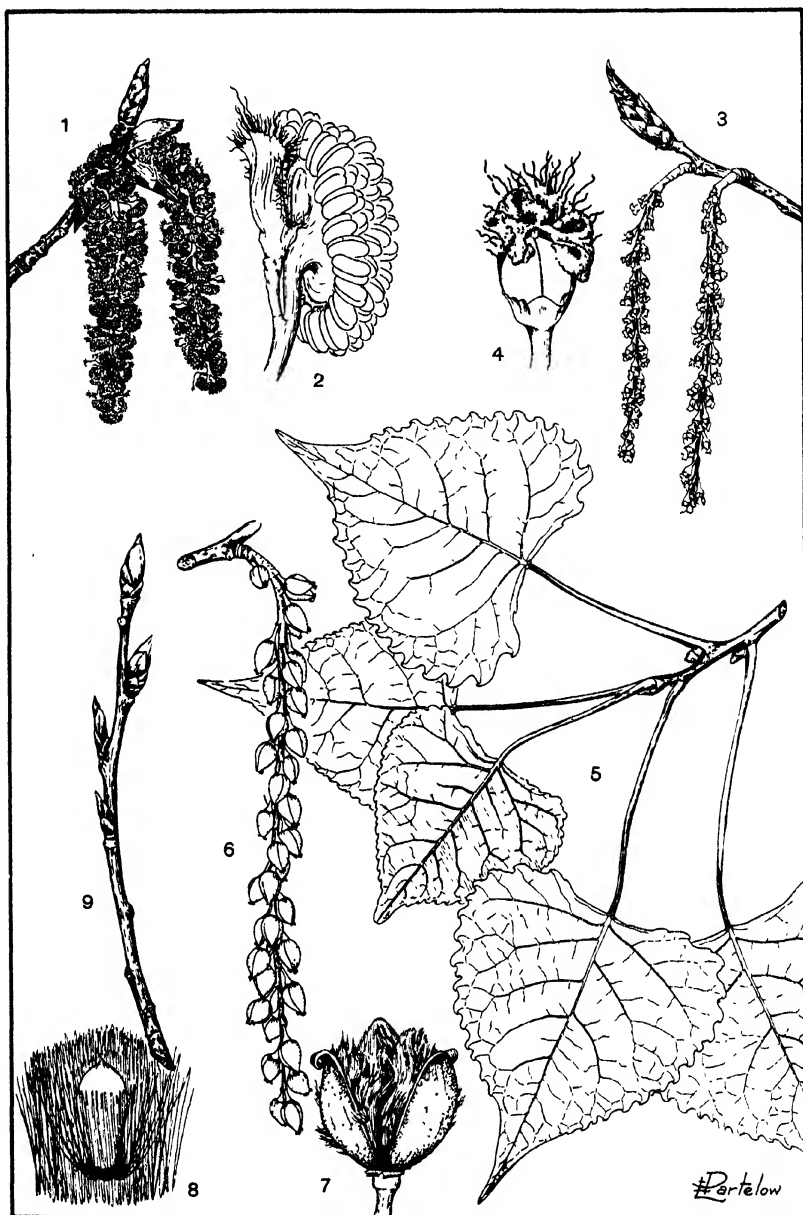
Fruit—A short-pedicellate, smooth, lustrous, straw-colored or pale brown, conic-subulate capsule, rounded and somewhat cordate at the base, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long, opening by 2 opposite sutures at maturity to set free the minute, comose seeds.

Winter characters—Twigs slender, lenticellate, terete, smooth, lustrous, greenish yellow, at length dull gray and roughened by the leaf- and branch-scars. Terminal bud lacking. Lateral buds 1-scaled, oblong-ovate, bluntly acute and smooth, greenish yellow, $\frac{1}{4}$ — $\frac{3}{8}$ of an inch long. Mature bark dark brownish black, deeply fissured with narrow ridges, scaly at the surface.

Habitat—Readily propagated and not exacting as to soil requirements provided a sufficient supply of moisture is available. Thrives on gravelly or loamy, upland soils.

Range—A native of Europe and Asia, extensively cultivated but seldom escaping in this country.

Uses—An ornamental species largely used in parks, cemeteries, and private estates because of its dark green, lustrous, laurel-like leaves. Of no commercial significance in the United States other than for the above.



Cottonwood

Populus deltoides Marsh. [**Populus balsamifera** L.; **Populus balsamifera** var. **virginiana** (Castl.) Sarg.]

- | | |
|--|--|
| 1. A twig-tip showing staminate aments $\times \frac{1}{2}$ | 5. A twig with mature leaves $\times \frac{1}{2}$ |
| 2. A staminate flower, lateral view $\times 5$ | 6. Portion of a twig showing a fruiting ament $\times \frac{1}{2}$ |
| 3. A twig-tip showing pistillate aments $\times \frac{1}{2}$ | 7. Mature capsule $\times 2$ |
| 4. A pistillate flower, proximal view $\times 5$ | 8. Comose seed $\times 5$ |
| | 9. Winter twig $\times \frac{1}{2}$ |

SALICACEAE

Populus deltoides Marsh. [**Populus balsamifera** L.; **Populus balsamifera** var. **virginiana** (Castl.) Sarg.]

Cottonwood

Habit—A tree usually 60–80 feet in height with a trunk diameter of 2–4 feet, under optimum conditions occasionally 100 feet tall. Crown generally pyramidal in young trees, in more mature trees broad (sometimes 100 feet across) and open. Spreads naturally by root-suckers. Can be propagated by 'cuttings'.

Leaves—Alternate, borne on long, slender, smooth, flattened petioles $2\frac{1}{2}$ – $3\frac{1}{2}$ inches long, deltoid-ovate, acuminate at the apex, truncate, slightly cordate, or abruptly cuneate at the entire base, finely crenately serrate, 3–5 inches long and broad, more or less fragrant, with 2 glands at the base of the leaf-blade at the insertion of the petiole, at maturity thick and firm in texture, light bright green and lustrous above, paler and smooth below, with a stout yellow midrib often tinged with red toward the base.

Flowers—Appearing in April and May before the leaves from separate flower-buds, dioecious, borne in the axile of scarious, light brown, glabrous, obovate, lacinate scales, the whole forming a pendulous ament. Staminate aments cylindrical, stout, densely flowered, $1\frac{1}{2}$ –2 inches long. Pistillate aments linear-cylindrical, sparsely flowered, 3 – $3\frac{1}{2}$ inches long. Stamens 60 or more, with short filaments and large, dark red anthers, inserted on a broad, oblique, slightly thickened disk. Pistil solitary, enclosed about one-third in the cup-shaped disk, consisting of an ovoid ovary with 3–4 sessile, spreading, lobed stigmas.

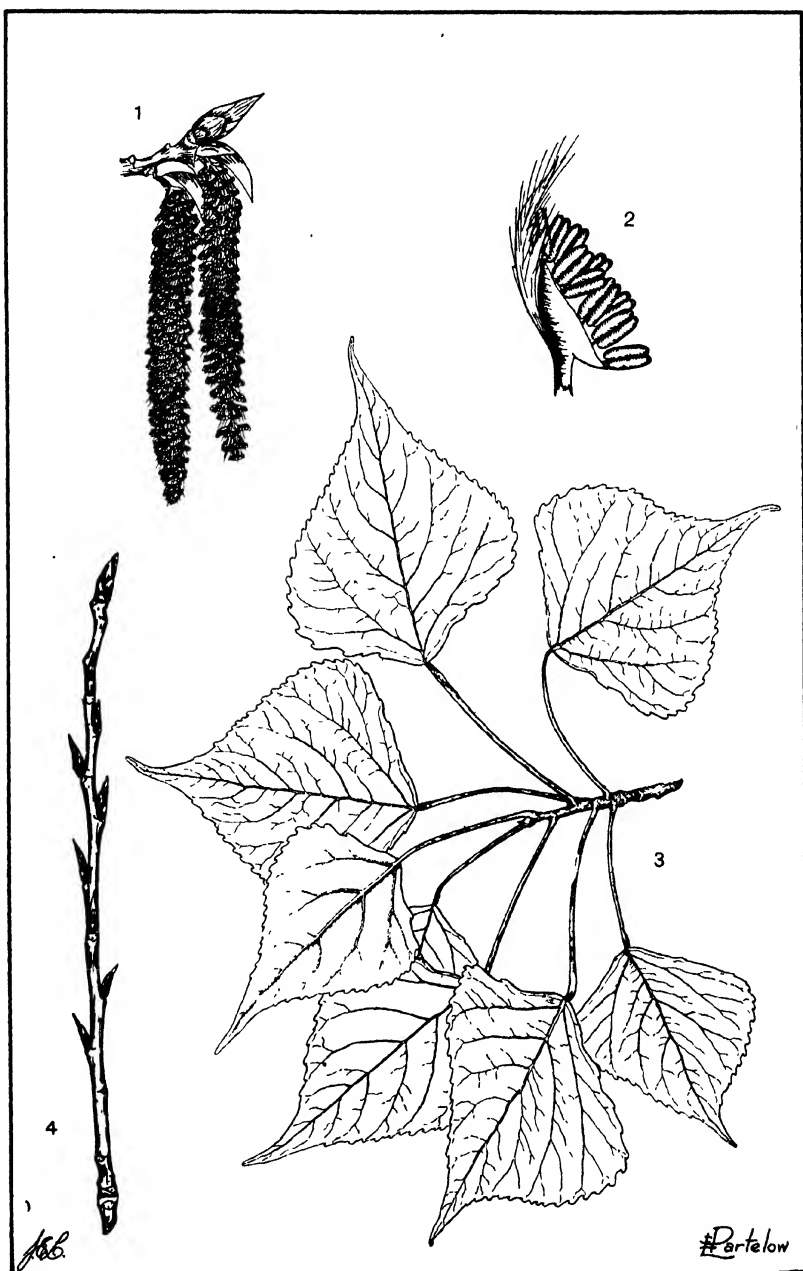
Fruit—An ellipsoidal, acute, green capsule, thin-walled and glabrous at maturity, about $\frac{1}{4}$ of an inch long, borne on a pedicel about $\frac{1}{4}$ th of an inch in length. The capsules are arranged loosely in naked, pendent, thin-stemmed aments 8–12 inches long, and open in May or early June by 3–4 valves to set free the minute, light brown, white-comose seeds.

Winter characters—Twigs stout, with long pale lenticels, terete or on vigorous trees frequently becoming angled the second year with thin, more or less prominent wings, glabrous, somewhat lustrous, pale yellow-brown. Buds conical to narrowly ovate, acute, smooth, lustrous, chestnut-brown, covered by 6–7 scales. Flower- and leaf-buds distinct. Terminal buds up to $\frac{1}{4}$ ths of an inch in length. Lateral buds somewhat shorter, generally divergent and often strongly curved. First scale of lateral buds anterior. Outer scales slightly resinous-sticky, inner scales thickly coated with a light yellow resin which is somewhat fragrant and bitter to the taste. Mature bark ashy-gray, thick, deeply fissured with broad, rounded ridges.

Habitat—A moisture-loving, rapidly growing species preferring rich alluvial soils along the banks of streams, and on moist meadows and bottomlands where it often forms extensive, open groves.

Range—Province of Quebec and the shores of Lake Champlain through western New England and western New York, Pennsylvania west of the Allegheny Mountains to southern Minnesota and the Dakotas, in the East extending south from Delaware through the Atlantic States to Florida, in the West through the eastern sections of the prairie states to eastern Texas.

Uses—Wood light, soft, weak, brittle, difficult to season and warping badly in drying, grayish brown with thick, nearly white sapwood. Used for cheap lumber, packing cases, etc. Often planted for shelter and ornament about ranch-buildings and along the streets of towns in the treeless plains east of the Rocky mountains; it is also occasionally found as a street-tree in the East where it is frequently confused with the Carolina Poplar. The roots not infrequently clog sewers and the pistillate trees are objectionable at seed-time because of the quantity of cottony material which is shed.



Carolina Poplar

× *Populus canadensis* var. *eugeniei* (Simon-Louis) Schelle
 [*Populus eugeniei* Hort. ex Dode]

1. A twig-tip showing staminate aments × $\frac{1}{2}$ 3. A twig showing mature leaves × $\frac{1}{2}$
 2. A staminate flower, lateral view × 5 4. Winter twig × $\frac{1}{2}$

SALICACEAE

× *Populus canadensis* var. *eugenei* (Simon-Louis) Schelle*
[*Populus eugenie* Hort. ex Dode]

Carolina Poplar

Habit—A tree usually 50—70 feet in height with a trunk diameter of 2—3 feet, under optimum conditions sometimes 100 feet tall and 5—6 feet in diameter. Crown at first narrow-pyramidal, with age becoming rounded and open and nearly as broad as long. Limbs sparse, stout, ascending or the lower horizontal. Lower branchlets somewhat drooping. Bole tapering and continuous well into the high crown. Spreads naturally by root suckers, trees occasionally being found which have arisen as 'escapes' in this way. Propagates readily by branch-cuttings. Branch-casting (cladoptosis) is very striking in this species, occurring as a natural process with the first cold rains of early autumn; branches several feet in length are not infrequently cast-off in this way.

Leaves—Unfolding early and reddish while young, alternate, borne on long, slender, smooth, flattened petioles 2—3 inches long, rhombic-ovate, long-acuminate at the apex, usually broad-cuneate at the base, coarsely crenate serrate with incurved glandular teeth and sparsely ciliate, 2—6 (usually about 3) inches long and wide, generally devoid of glands at the base of the leaf-blade at the insertion of the petiole, at maturity thick and firm in texture, light bright green and lustrous above, paler and smooth below, with a stout yellow midrib.

Flowers—Appearing in April and May before the leaves from separate flower-buds, of one sex only (staminate), borne in the axils of scarious, light brown, glabrous or hairy, obovate, lacinate scales, the whole forming a stout, cylindrical, densely flowered, pendulous ament 2—3 inches long. The staminate aments fall in immense numbers shortly after the pollen is set free. Stamens 15—20, with short, thread-like filaments and large, dark red anthers, inserted on a broad, oblique, slightly thickened disk.

Winter characters—Similar to those of the cottonwood described on the preceding page but the twigs never as strongly angled. The buds are also generally smaller and are viscid.

Habitat—Not exacting in its soil requirements. Like the cottonwood, it thrives best on sites where ample moisture is available but where good drainage is assured.

Range—Undoubtedly a tree of nursery origin but now planted in immense numbers in the United States. Found occasionally as an 'escape', spreading by root-suckers.

Uses—The wood possesses the same characteristics and is put to the same uses as that of cottonwood, in fact is not distinguished from the wood of that species in the trade. Extensively used as a street tree where quick landscape-effects are desired, lending itself to this purpose because of its ease of propagation by 'cuttings' and rapidity of growth. Not to be recommended because it is short-lived and further, because the roots cause trouble by penetrating and clogging drains and sewers. When trees are to be removed, they should be girdled in the spring and allowed to stand until autumn, thus discouraging the formation of numerous root-sprouts.

*If the origin of this tree is correctly understood, it is a variety of a hybrid obtained by crossing the Northern Cottonwood, *P. balsamifera* L., with the Lombardy Poplar, *P. nigra* var. *italica* Dur.



Large-toothed Aspen

Populus grandidentata Michx.

- | | |
|---|--|
| 1. A twig-tip showing staminate aments x $\frac{1}{4}$ | 5. A twig showing mature leaves x $\frac{1}{2}$ |
| 2. A staminate flower, lateral view x 5 | 6. A twig showing immature foliage and fruiting aments x $\frac{1}{2}$ |
| 3. A twig-tip showing pistillate aments x $\frac{1}{4}$ | 7. Mature capsule x 4 |
| 4. A pistillate flower, proximal view x 5 | 8. Comose seed x 8 |
| | 9. Winter twig x $\frac{1}{2}$ |

SALICACEAE

Populus grandidentata Michx.

Large-toothed Aspen

Habit—A tree at maturity sometimes attaining a height of 60—70 feet with a trunk diameter of 1—2 feet, usually 25—50 feet tall. Crown narrow, round-topped, open, consisting of slender, rather rigid branches and stout twigs. Very intolerant. Spreads by root suckers but propagation by 'cuttings' is poor. A shorter-lived tree than Trembling Aspen.

Leaves—Alternate, borne on slender, flattened petioles $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long, broadly ovate to orbicular, acuminate at the apex, truncate to broadly cuneate at the base, coarsely sinuate-dentate with callous-mucronate teeth, 2—4 inches long, $2\frac{1}{2}$ — $3\frac{1}{2}$ inches wide, at first densely white-tomentose,* at maturity thin but firm in texture, dark green and smooth above, smooth and glaucescent below.** Stipules linear, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, fugacious. The leaves of this species appear a week or two after those of Trembling Aspen.

Flowers—Appearing in late March and April before the leaves from separate flower-buds, dioecious, borne in the axils of pale, gray-hairy scales which are divided above into 4—6 short, acute lobes, the whole forming cylindrical, hairy aments $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long. Perianth wanting. Stamens 6—12, with short, slender filaments and reddish anthers, inserted on an oblique, shallow disk. Pistil solitary, enclosed at the base in the tubular, slightly oblique disk, consisting of an oblong-conical, green, puberulous ovary, a short style, and 2 spreading, lobed stigmas.

Fruit—A curved, oblique, conical, pedunculate capsule, at maturity pale green and puberulous, thin-walled, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. The capsules are borne loosely in naked, pedunculate aments 5—6 inches long and open in May and early June as the leaves unfold to set free the minute, brown, white-comose seeds.

Winter characters—Twigs rather stout, lenticellate, smooth and lustrous or gray-pubescent (especially toward the apex), dark reddish or yellowish brown, at length dark gray and roughened by the leaf- and lateral twig-scars. Flower- and leaf-buds distinct. Leaf-buds broadly ovate, divergent, light chestnut-brown, grayish puberulous, covered by 6—7 rounded scales (the first scale anterior), about $\frac{1}{8}$ of an inch long. Flower-buds similar but larger and more strongly divergent. Mature bark appearing tardily at the base of old trees, dark brownish black, thick, firm, roughened by fissures and broad, flat ridges. Bark higher on the bole and on the larger limbs thinner, smooth, light greenish gray.

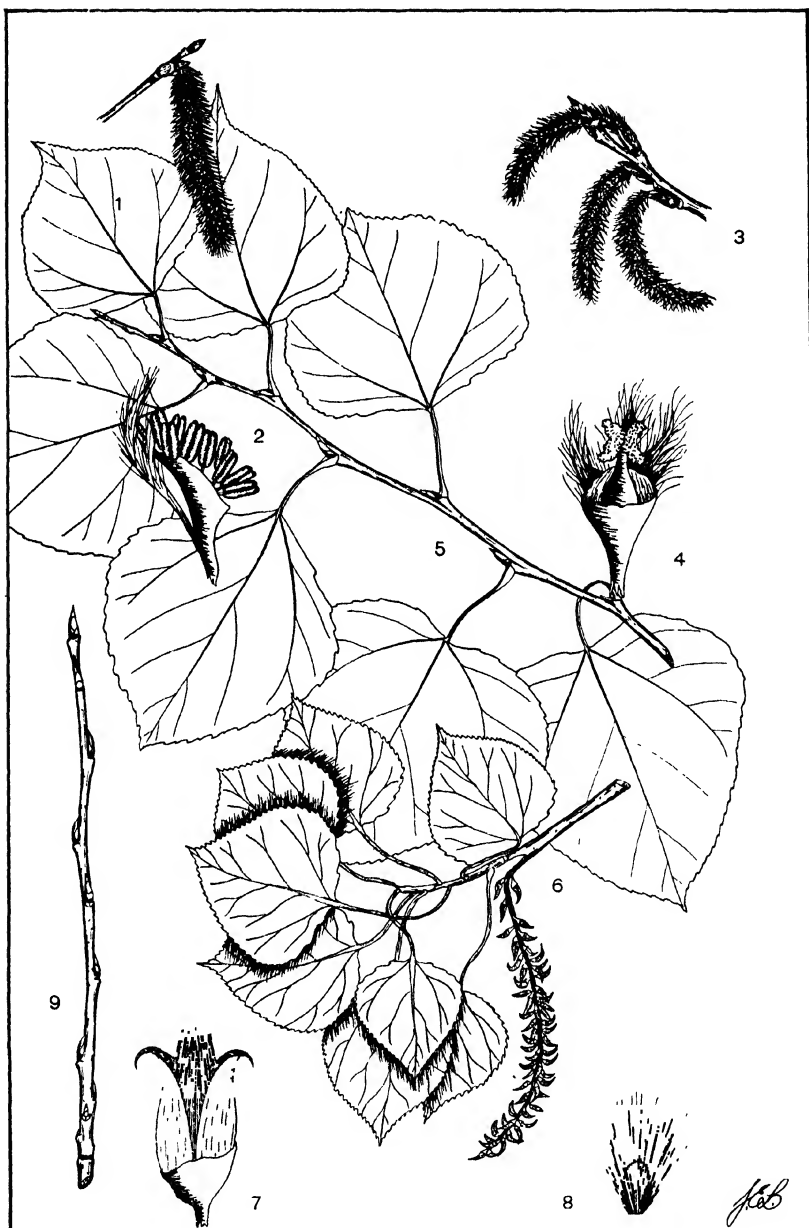
Habitat—A 'weed' tree, attaining its best development on rich, deep, moist soils but found on a wide variety of sites on dry, sandy or stony uplands. In scattered groups in the forest, frequently mixed with Trembling Aspen or forming a temporary upper story over other hardwoods.

Range—Nova Scotia through New Brunswick, southern Quebec, and Ontario, in the United States from Maine to North Dakota, south in the mountains to North Carolina.

Uses—Most important silviculturally because of the rapidity with which it comes in on slashes and burns, establishing a forest cover which permits more valuable species to reestablish themselves. Wood light, soft, weak, close-grained, pale brown with nearly white sapwood. Not distinguished in the trade from that of Trembling Aspen. Used for excelsior, pulp and occasionally for wooden ware.

*In landscapes the trees can readily be distinguished from those of Trembling Aspen at this stage because of the grayish color of the foliage.

**The juvenile leaves on the sprout-growth of this species are quite misleading; they are much larger, resemble those of Swamp Poplar, have a finely serrated margin, and are densely pale tomentose.



Trembling Aspen, Quaking Aspen, Aspen

Populus tremuloides Michx.

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|--|--|
| 1. A twig-tip showing staminate ament $\times \frac{1}{2}$ | 5. A twig showing mature leaves $\times \frac{1}{2}$ |
| 2. A staminate flower, lateral view $\times 5$ | 6. A twig showing immature foliage and fruiting ament $\times \frac{1}{2}$ |
| 3. A twig-tip showing pistillate aments $\times \frac{1}{2}$ | 7. Mature capsule $\times 4$ |
| 4. A pistillate flower, proximal view $\times 5$ | 8. Comose seed $\times 5$ |
| | 9. Winter twig $\times \frac{1}{2}$ |

SALICACEAE

Populus tremuloides Michx.

Trembling Aspen, Quaking Aspen, Aspen

Habit—At maturity usually a medium-sized tree 50—60 feet in height with a trunk diameter of 8—14 inches, under optimum conditions sometimes 100 feet tall. Crown narrow, round-topped, open and irregular, consisting of slender, somewhat ascending branches which often droop at the tip. Bole in large trees with little taper until the crown is reached, in smaller trees tapering gradually into the crown. Very intolerant. Produces abundant seed but these retain their viability for only a short time. Sprouts from the stump and roots but propagation by 'cuttings' is poor.

Leaves—Alternate, borne on slender petioles $1\frac{1}{2}$ —3 inches long, broadly ovate to orbicular, short-acuminate at the apex, truncate to broad-cuneate at the base, finely glandular-serrate, $1\frac{1}{2}$ —3 inches in diameter, when they first appear smooth, lustrous, pale green with ciliate margins, at maturity thin, firm, smooth, dark green and lustrous above, dull yellowish green, glabrous, and glaucescent below.

Flowers—Appearing in late March and April before the leaves from separate flower-buds, dioecious, borne in the axils of laciniately 3—4 lobed, hairy scales, the whole forming cylindrical, hairy aments $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long. Perianth wanting. Stamens 6—12, with short, slender filaments and reddish anthers, inserted on an oblique shallow disk. Pistil solitary, enclosed at the base in the tubular, slightly oblique disk, consisting of a conical, green, puberulous ovary, a short style, and 2 spreading, lobed stigmas.

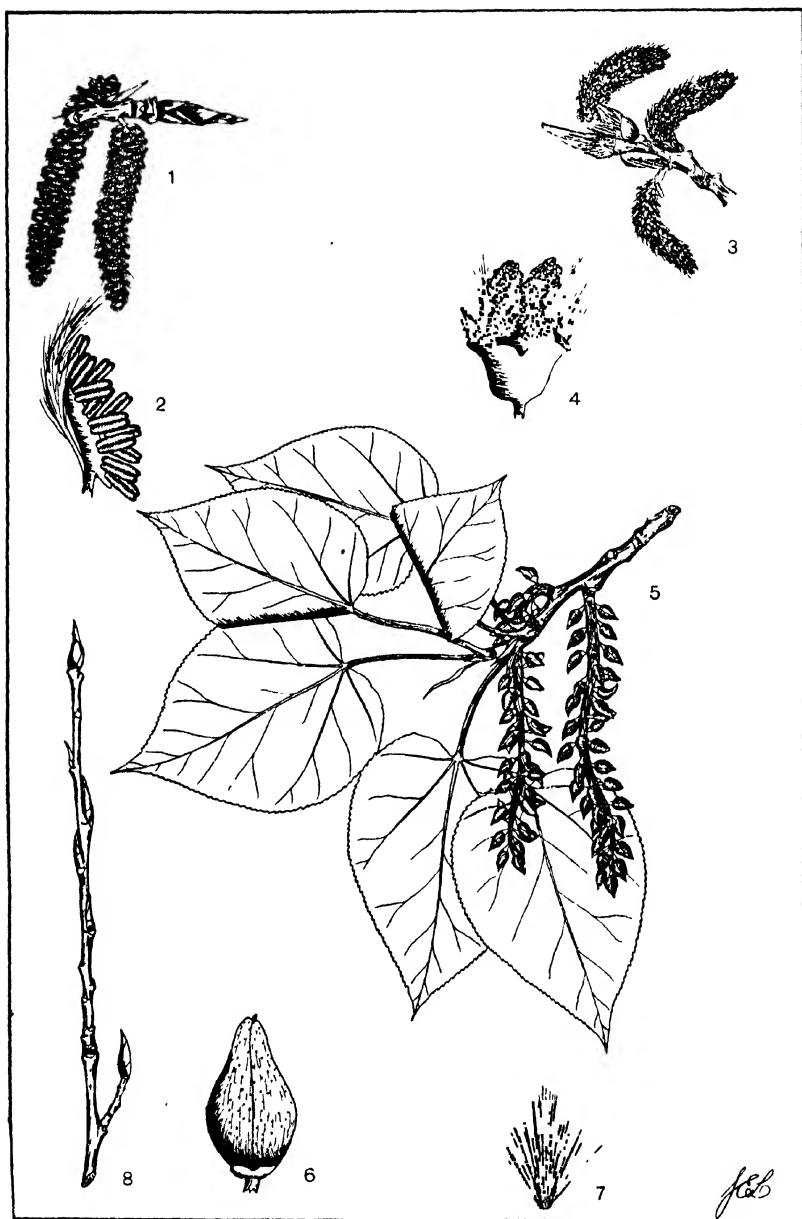
Fruit—A curved, pale green, thin-walled capsule, about $\frac{1}{4}$ of an inch long. The capsules are borne rather loosely in naked, pedunculate aments 3—4 inches long, mature in May and June before the leaves have attained full size, and open by opposite sutures to set free the minute, light brown, white-comose seeds.

Winter characters—Twigs rather slender, lenticellate, smooth and lustrous, reddish brown, at length dark gray and roughened by the leaf- and lateral branch-scars. Flower- and leaf-buds distinct. Leaf-buds conical and somewhat curved, slightly resinous, acute, about $\frac{1}{4}$ of an inch long, covered by 6—7 lustrous and glabrous, reddish brown scales scarious on the margins. Flower-buds similar but larger, more obtuse and divergent. Mature bark appearing rather tardily at the base of the old trees, nearly black, thick, roughened by deep fissures and broad, flat ridges. Bark higher on the bole and on the larger limbs thinner, smooth, yellowish green to nearly white, roughened by areas of wart-like excrescences.

Habitat—A 'weed' tree thriving on a variety of sites, swamps excepted, but preferring rather dry, upland soils. Frequent in slashes and burns, on abandoned fields, limestone hills, etc.

Range—A widely distributed species extending nearly across Canada from southern Labrador through the Hudson Bay region to Alaska, south in the United States to New Jersey and west through central Illinois to Nebraska, in the Rockies to Mexico and in the Sierra to California.

Uses—Wood light, soft, weak, close-grained, pale grayish brown with nearly white sapwood. Largely used with Spruce and Fir in the manufacture of pulp, also for excelsior. Occasionally sawed into lumber and used for turnery, etc. Like the Large-toothed Aspen, this species is valuable as a cover-tree, establishing itself quickly in slashes and burns and protecting the soil until more valuable, slower-growing species can dominate the terrain. Several varieties of this species are recognized of which var. *aurea* Daniels, the Rocky Mountain form, is the best known.



Balsam Poplar, Tacamahac

Populus tacamahaca Mill. [*Populus balsamifera* Dur., not L.]

- | | |
|--|---|
| 1. A twig-tip showing staminate aments $\times \frac{1}{2}$ | 5 A twig showing mature leaves and fruiting aments $\times \frac{1}{2}$ |
| 2. A staminate flower, lateral view $\times \frac{1}{6}$ | 6. Mature capsule $\times 3\frac{1}{2}$ |
| 3. A twig-tip showing pistillate aments $\times \frac{1}{2}$ | 7. Comose seed $\times \frac{7}{7}$ |
| 4. A pistillate flower, proximal view $\times \frac{1}{5}$ | 8. Winter twig $\times \frac{1}{2}$ |

SALICACEAE

Populus tacamahaca Mill. [*Populus balsamifera* Dur., not L.]

Balsam Poplar, Tacamahac

Habit—A medium-sized tree generally attaining a height of 60–70 feet with a trunk diameter of 1–3 feet, under optimum conditions in the forest sometimes 100 feet tall.* Crown rather narrow, irregular, open, bluntly pyramidal in exposed trees, consisting of stout, sparse, erect branches which are bushy at the ends. Propagates by root suckers.

Leaves—Alternate, borne on slender, smooth, terete petioles 1–2 inches long, ovate to ovate-lanceolate, acute or short-acuminate at the apex, rounded or cordate at the base, finely crenate-serrate with glandular teeth, 3–5 inches long, 1½–3 inches wide, at maturity rather thick and firm in texture, dark green and lustrous above, paler, with rusty blotches and reticulate-veined below. Stipules oblong-lanceolate, ciliate, about ⅓ of an inch long, tardily fugacious.

Flowers—Appearing in April and May before the leaves from separate flower-buds, dioecious, borne in the axils of light brown, obovate, hairy, lacinate scales, the whole forming pendulous, densely flowered, hairy, cylindrical aments, 2–2½ inches long. Perianth wanting. Stamens 12–20, with short, slender filaments and light red anthers, inserted on an oblique, short-stalked, shallow disk. Pistil solitary, enclosed at the base by the cup-shaped, slightly lobed disk, consisting of an ovoid, slightly 2-lobed ovary capped by 2 large, nearly sessile stigmas.

Fruit—An ovoid-oblong, light brown, thick-walled, pedunculate capsule, acute and often curved at the apex, about ¼ of an inch long. The capsules are borne rather closely in pedunculate, stout-stalked, naked aments 4–5 inches long and open by 2 opposite sutures in late May or June to set free the minute, pale brown, white-comose seeds.

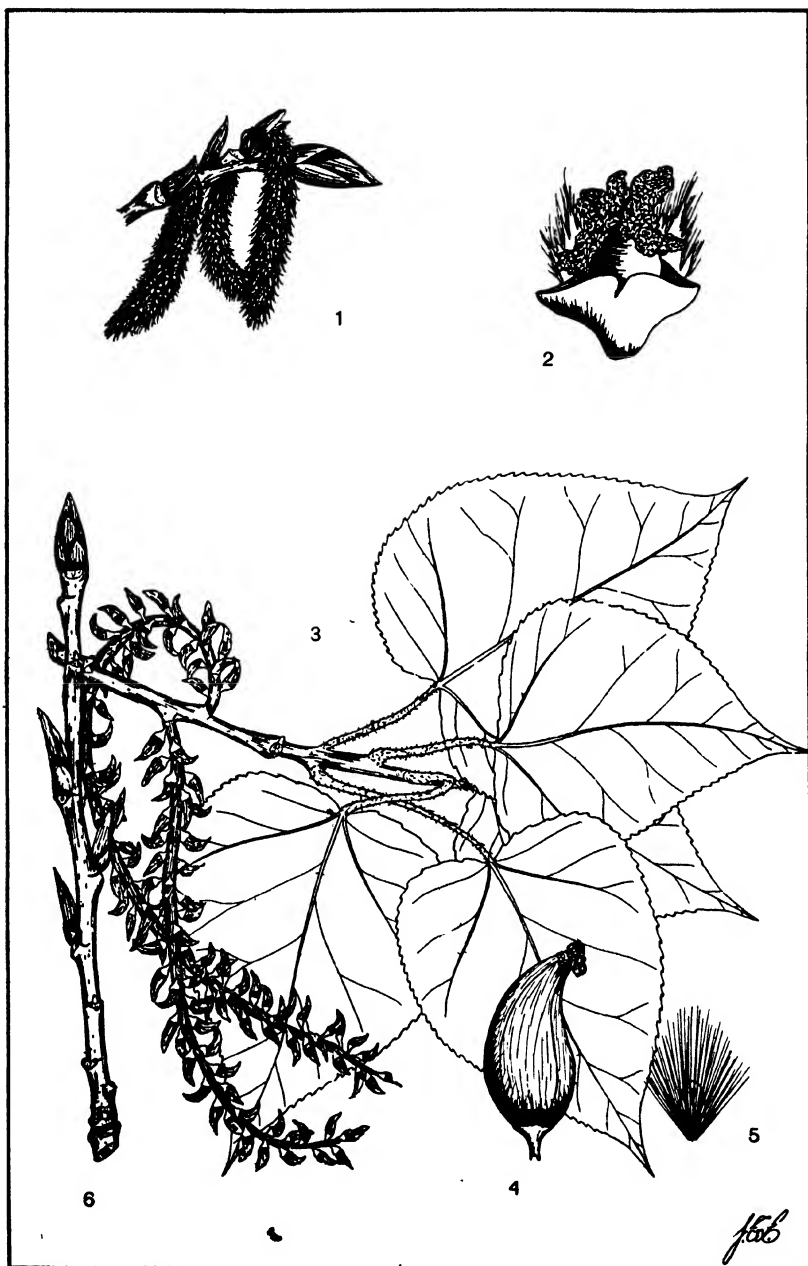
Winter characters—Twigs stout, lenticellate, smooth, lustrous, bright reddish brown, at length dull orange and finally yellowish or greenish gray. Flower- and leaf-buds distinct. Leaf-buds ovate, acuminate, usually divergent, dark red, water-proofed with a fragrant, amber-colored resin which exhales a pleasing odor as the buds unfold in the spring, ½–1 inch long. Flower-buds similar but somewhat broader. Bark on young trunks and limbs smooth, light reddish brown. Mature bark dark gray tinged with red, thick, with narrow fissures and broad scaly ridges.

Habitat—Prefers alluvial soils in the bottom-lands of river valleys, along banks of streams and lake shores, borders of swamps, etc. A moisture-loving species, occasionally growing in drier situations. Forms open pure stands or occurs in mixture with willows, alders, birches and spruce.

Range—A transcontinental species widely spread throughout Canada from Labrador to Alaska, south into northern New England, New York, Michigan, Wisconsin, Minnesota, Nebraska, Colorado, Nevada and Oregon.

Uses—Wood light, soft, weak, close-grained, pale brown with thick, nearly white sapwood. Mixed with that of other species in the manufacture of pulp. Occasionally manufactured into small wooden containers such as pails and boxes, excelsior, etc. Primarily a Canadian tree.

*This species attains its greatest size in the far northwest (MacKenzie River valley of northwestern Canada).



Balm of Gilead

Populus candicans Ait. [**Populus balsamifera** var. **candicans** (Ait.) Gray]

- | | |
|--|--------------------------------|
| 1. A twig-tip showing staminate aments x $\frac{1}{2}$ | 4. Mature capsule x 2 |
| 2. A pistillate flower, proximal view x 4 | 5. Comose seed x 5 |
| 3. A twig showing mature foliage and fruiting aments x $\frac{1}{2}$ | 6. Winter Twig x $\frac{1}{2}$ |

SALICACEAE

Populus candicans Ait. [**Populus balsamifera** var. **candicans** (Ait.) Gray]

Balm of Gilead*

Habit—A tree at maturity 50—80 feet high with a trunk diameter of 2—4 feet, occasionally 100 feet tall. Crown rather broad, irregular and open, consisting of stout, sparse, spreading, somewhat drooping limbs. A short-lived tree propagating readily by suckers.

Leaves—Alternate, borne on slender, pubescent, terete petioles $1\frac{1}{2}$ — $2\frac{3}{4}$ inches long, broadly ovate to ovate-deltoid, acuminate at the apex, cordate or truncate at the base, coarsely crenate-serrate with glandular teeth (teeth larger than those of Balsam Poplar which resembles this species) and ciliate on the margin, 4—6 inches long, 2—4 inches wide, at maturity thin but firm in texture, dark green and slightly pubescent above, paler, sparingly pubescent, and hairy on the veins beneath. Stipules oblong-lanceolate ciliate, about $\frac{1}{2}$ of an inch long, tardily fugacious.

Flowers—Appearing in April and May before the leaves from separate flower-buds, of one sex (pistillate), borne in the axils of light brown, obovate, hairy, lacinate scales, the whole forming pendulous, densely flowered, cylindrical aments $2\frac{1}{2}$ —4 inches long. Perianth wanting. Pistil solitary, enclosed at the base by the cup-shaped, slightly lobed disk, consisting of an ovoid, slightly lobed ovary capped by 2 large, sessile stigmas.

Fruit—A narrowly ovoid, pale brown, thick-walled, pedunculate capsule, acute and often curved at the apex, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. The capsules are borne rather loosely in pendunculate, stout-stalked, naked aments 4— $6\frac{1}{2}$ inches long and open by 2 opposite sutures in late May or June to set free the minute, pale brown, white-comose seeds.

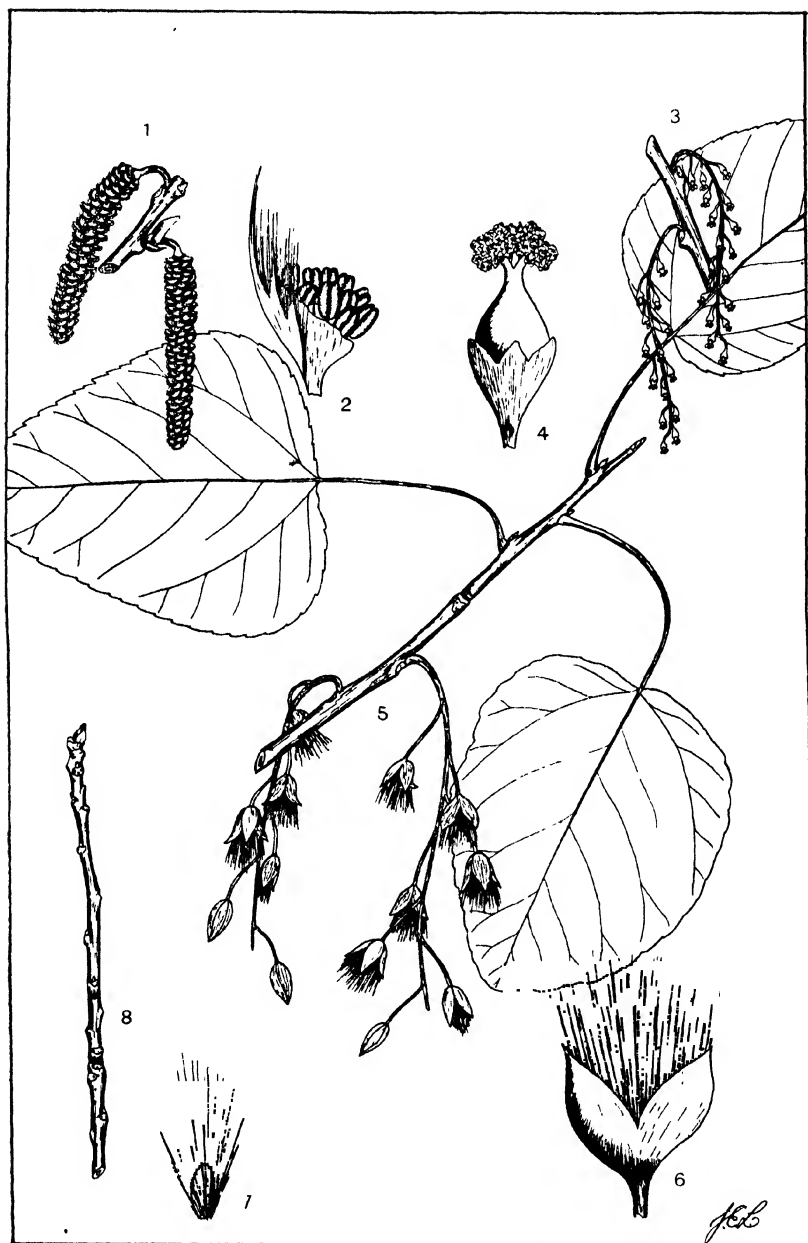
Winter characters—Twigs stout, lenticellate, smooth, lustrous, reddish brown, at length dull yellowish or greenish gray. Flower- and leaf-buds distinct. Leaf-buds narrowly ovate, acuminate, somewhat divergent, dark red, water-proofed with a very fragrant, amber-colored resin which exhales a pleasing odor as the buds unfold in the spring, $\frac{1}{2}$ —1 inch long. Flower-buds similar, usually broadly ovate. Mature bark dark gray, thick, with narrow fissures and broad, scaly ridges.

Habitat—In deep, moist soil about dwellings and dooryards, occasionally escaping and sometimes forming groves.

Range—Imperfectly known. Widely planted in North America from Newfoundland to Alaska, south to Virginia and Missouri.

Uses—A fast-growing species planted ornamentally about dwellings but not to be recommended because of its short life and unsightly appearance in age. Suckers from these trees are a nuisance about dooryards. Wood similar to that of Balsam Poplar and occasionally used for the same purposes.

*The origin of this tree is in doubt. The presence of pistillate flowers only suggests that it may be a hybrid, possibly a hybrid between a native and a foreign species of *Populus*. It differs from Balsam Poplar in its more spreading branches which form a broader, more open crown, and in its larger, cordate, more coarsely-toothed leaves with pubescent petioles.



Swamp Cottonwood, Swamp Poplar, Downy Poplar
Populus heterophylla L.

1. Portion of a twig showing staminate aments $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. Portion of a twig showing pistillate aments $\times \frac{1}{2}$
4. A pistillate flower, proximal view $\times 5$
5. A twig showing mature leaves and fruiting aments $\times \frac{1}{2}$
6. Mature capsule $\times 4$
7. Comose seed $\times 6$
8. Winter twig $\times \frac{1}{2}$

SALICACEAE
***Populus heterophylla* L.**

Swamp Cottonwood, Swamp Poplar, Downy Poplar

Habit—In the northeastern portion of its range a small tree 25—40 feet in height with a trunk diameter of 12 inches or less, farther south sometimes 90—100 feet tall, often shrubby in cultivation. Crown rather narrow, open, round-topped, consisting of a few large limbs which are irregularly arranged. Bole in large trees straight and columnar, bearing a high crown. In small trees it is much shorter and tapering, and continues into the crown.

Leaves—Alternate, borne on hairy, terete petioles 2—3½ inches long, broadly ovate, obtuse or subacute at the apex, rounded to cordate at the base, crenate-serrate, 4—8 inches long 3—5 inches wide, tomentose when unfolding, at maturity thin but firm in texture, dark green and smooth above, paler and glabrous or floccose below, with yellow midrib. Stipules linear-lanceolate, ½—1 inch long, fugacious.

Flowers—Appearing in April or May before the leaves from separate flower-buds, dioecious, borne in the axils of brown, oblong-obovate scales which are divided above into numerous filiform lobes, the whole forming aments. Staminate aments cylindrical, stout, densely flowered, at first short and erect, finally pendent, 2—2½ inches long. Pistillate aments broad, cylindrical, few-flowered, pendent, 1—2 inches long. Stamens 12—20, with short, slender filaments and dark red anthers, inserted on an oblique shallow disk. Pistil solitary, enclosed at the base in the campanulate, lobed, deciduous disk, consisting of an ovoid ovary, a short style, and 2—3 spreading, lobed stigmas.

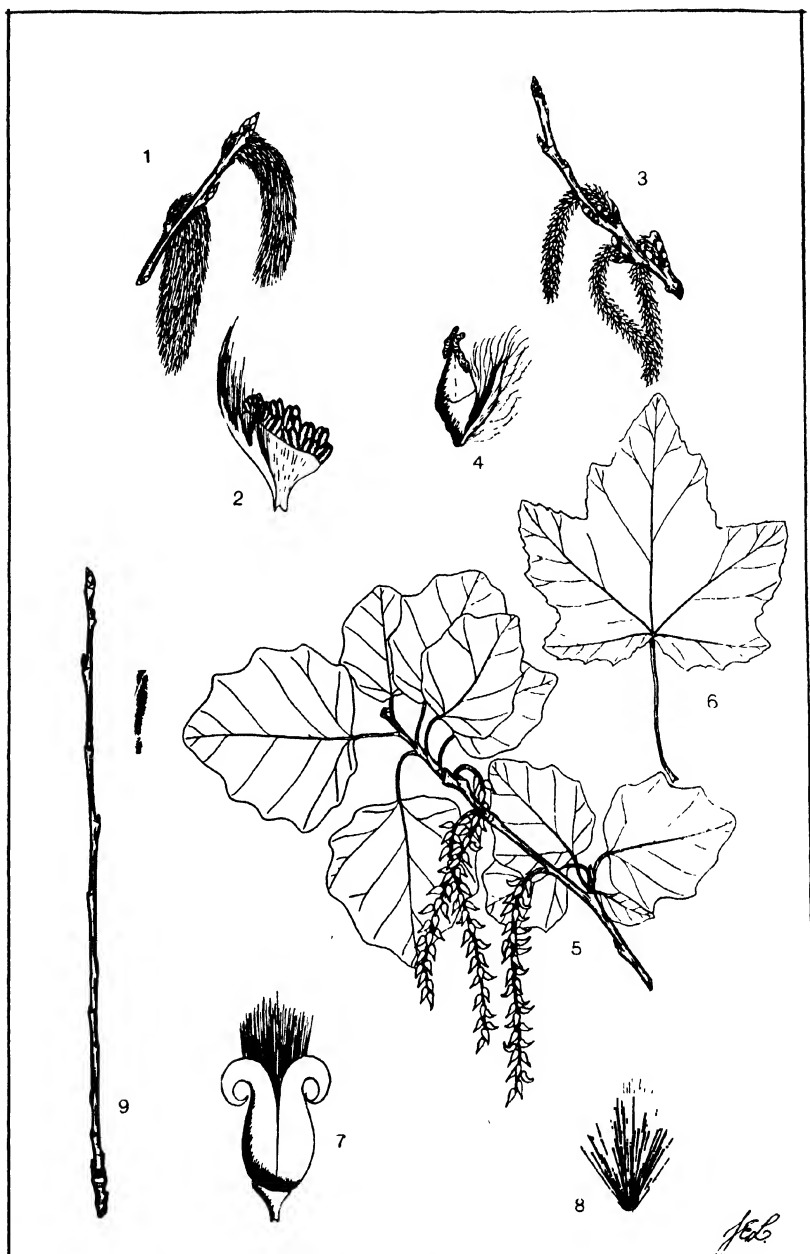
Fruit—An ovoid-oblong smooth, thick-walled, long-pedicellate, reddish brown capsule, about ¼ of an inch long. The capsules are borne loosely in naked aments 4—6 inches long which open in May when the leaves are about half grown by 2—3 sutures to set free the minute, dark brown, white-comose seeds.

Winter characters—Twigs stout, lenticellate, at first velvety, soon becoming lustrous or dull grayish or reddish brown, with conspicuous orange-colored pith. Flower- and leaf-buds distinct. Leaf-buds ovate, acute, puberulous, reddish brown, covered by 4—7 scales, about ¼ of an inch long. Flower-buds similar, broadly ovate, more strongly divergent, about ½ of an inch long. Mature bark light reddish brown and thick, with narrow, shallow fissures and long, narrow, flat ridges.

Habitat—A moisture-loving tree occurring in mixture with other species in low, swampy situations, often where the soil is inundated for long periods each year.

Range—Connecticut south in the coastal swamps to Georgia, through the Gulf States to western Louisiana, thence north in the Mississippi Basin to western Kentucky and southeastern Missouri, thence eastward through southern Illinois, s. Indiana, and s. Ohio.

Uses—Of little economic significance. Wood light, soft, weak, close-grained, pale brown with thin, brownish white sapwood. Occasionally sawed into lumber in the Lower Mississippi Basin.



White Poplar, Silver-leaved Poplar, Abele

Populus alba L. and *Populus alba* var. *nivea* Ait.

- | | |
|---|---|
| 1. A twig-tip showing staminate aments x $\frac{1}{2}$ | 5. A twig with mature leaves and fruiting aments x $\frac{1}{2}$ |
| 2. A staminate flower, lateral view x 5 | 6. A leaf of <i>Populus alba</i> var. <i>nivea</i> Alt. x $\frac{1}{2}$ |
| 3. A twig-tip showing pistillate aments x $\frac{1}{2}$ | 7. Mature capsule x 5 |
| 4. A pistillate flower, lateral view x 5 | 8. Comose seed x 10 |
| | 9. Winter twig x $\frac{1}{2}$ |

SALICACEAE

Populus alba L. and **Populus alba** var. **nivea** Ait.

White Poplar, Silver-leaved Poplar, Abele

Habit—A large tree, sometimes attaining a height of 80—100 feet with a trunk diameter of 2—4 feet, usually 40—70 feet tall. Crown irregular, open, broad and round-topped. Bole massive, breaking up 10—20 feet above the ground into stout, ascending limbs and arching, somewhat pendant twigs. Propagates abundantly by root-suckers.

Leaves—Alternate, borne on long, slender, white-tomentose or nearly glabrate, terete petioles, in the type-form suborbicular to broadly ovate, obtuse or acute at the apex, truncate or cordate at the base, irregularly sinuate-dentate, 2—4½ inches long, at maturity firm, dark green, smooth, and somewhat lustrous above, white-tomentose or pale-glabrate below. The variety, **Populus alba** var. **nivea** Ait., with palmately 3—5-lobed leaves which are white velvety-tomentose below, is a common 'escape' in this country.

Flowers—Appearing before the leaves from separate flower-buds, dioecious, borne in the axils of obovate, dentate, hairy scales, the whole forming pendulous, densely flowered, hairy, cylindrical aments 2—3 inches long. Perianth wanting. Stamens 6—10, with short slender filaments and pale purple anthers, inserted on the oblique, cup-shaped disk. Pistil solitary, enclosed at the base by the closely appressed disk, consisting of an ovoid ovary and 2 nearly sessile, 2-lobed, yellow stigmas.

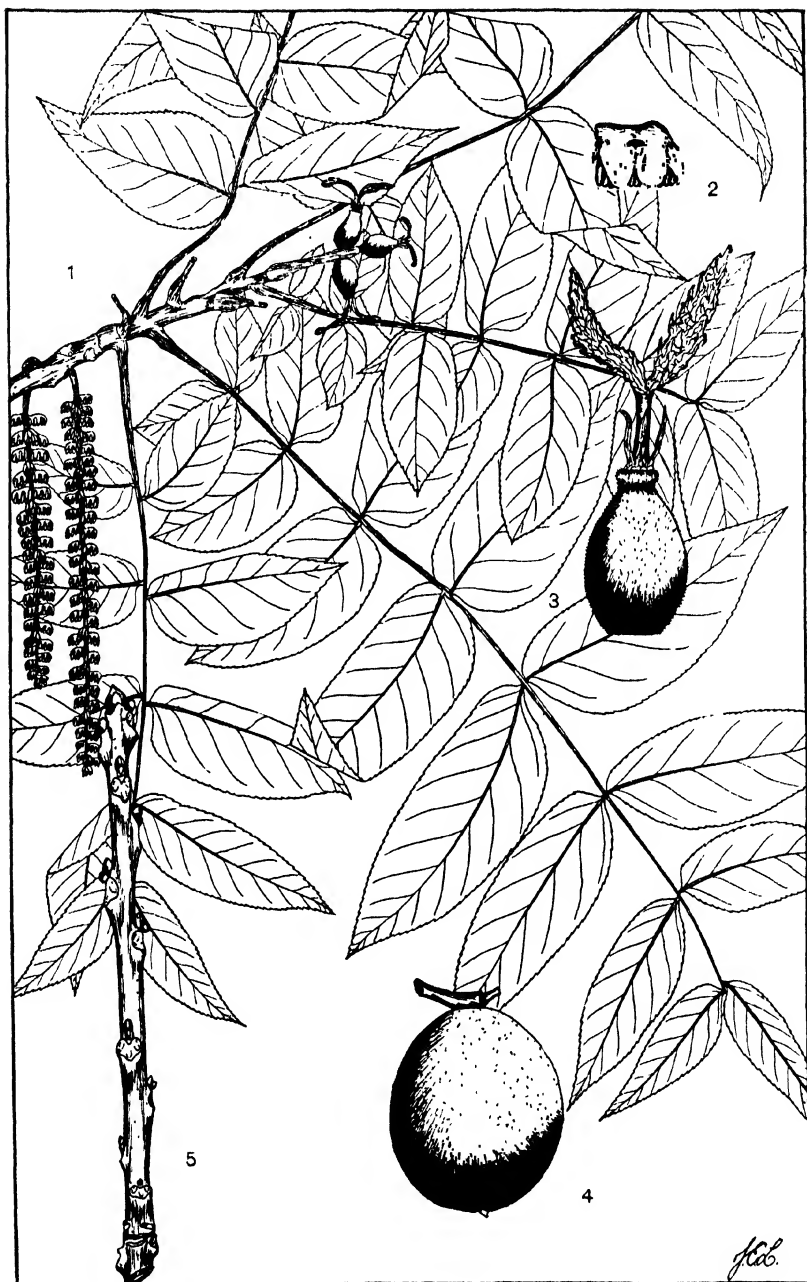
Fruit—An ovoid-oblong, canescent, short-pedicellate capsule, about ⅜ of an inch long. The capsules are borne in naked, pendent, rather stout-stemmed aments 2—2½ inches long, mature in late May or June, and open by 2 valves to set free the minute, white-comose seeds.

Winter characters—Twigs rather stout, lenticellate, purplish or olive-brown, white-tomentose, becoming smooth and gray the second season. Flower- and leaf-buds distinct. Leaf-buds ovate-oblong, acute, white-downy, ⅓—¼ of an inch long. Flower-buds ovoid, blunter and more divergent. Bark on young trees or large limbs grayish or greenish white, smooth or roughened by brownish warty excrescences. Mature bark brownish black, deeply fissured, with rough, irregular ridges.

Habitat—A rapidly growing tree thriving best in deep, moist, alluvial soils where a constant supply of moisture is assured.

Range—Central and southern Europe to western Siberia and central Asia. Long cultivated as an ornamental and shade tree about door-yards and estates, spreading readily, chiefly through root-suckers.

Uses—Valuable chiefly as an ornamental tree because of the showy underside of the leaves. Wood light, soft, weak, close-grained, pale reddish yellow with nearly white sapwood. Occasionally used for light fuel in this country, and abroad for packing cases and flooring.



Black Walnut

Juglans nigra L.

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|---|---|
| 1. A branch showing nearly mature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$ | 3. A pistillate flower, lateral view $\times \frac{1}{2}$ |
| 2. A staminate flower, lateral view $\times \frac{1}{2}$ | 4. Globose fruit $\times \frac{1}{2}$ |
| 5. Winter twig $\times \frac{1}{2}$ | |

JUGLANDACEAE

Juglans nigra L.

Black Walnut

Habit—A large tree 70—90 feet in height with a trunk-diameter of 2—3 feet, in the rich alluvial soils of the Ohio Basin sometimes attaining a height of 150 feet with a bole 5—6 feet in diameter. The trunk is straight and continuous into the crown, gradually breaking up into stout, spreading limbs which form a narrow or broad, round-topped crown. In tall individuals the bole is often clear of branches for 50—60 feet. The tree attains maturity in about 150 years.

Leaves—Alternate, odd-pinnately compound, 1—2 feet long, consisting of 13-23 sessile or nearly sessile leaflets arranged in pairs along a puberulent rachis, the terminal leaflet often suppressed. Leaflets ovate-oblong to ovate-lanceolate, 3—3½ inches long, 1—1¼ inches wide, acuminate at the apex, rounded and usually inequilateral at the base, sharply and finely serrate except at the base, at maturity thin, yellowish green, lustrous and glabrous above, soft glandular-pubescent beneath.

Flowers—Appearing in May and early June when the leaves are about half grown, monoecious, the staminate in stout, unbranched catkins 3—5 inches in length on the growth of the preceding season, the pistillate in terminal, 2—5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers about ¼ of an inch long, epaulet-shaped, consisting of a nearly triangular, rusty-tomentose bract bearing in the axil a rounded, 6-lobed perianth subtending 20—30 nearly sessile stamens; anthers purple. Pistillate flowers about ¼ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by a style and 2 clavate, ascending stigmas which are yellowish green tinged with red and ½—¾ of an inch long. The ovary is closely invested by glandular, adhering bracts and the calyx.

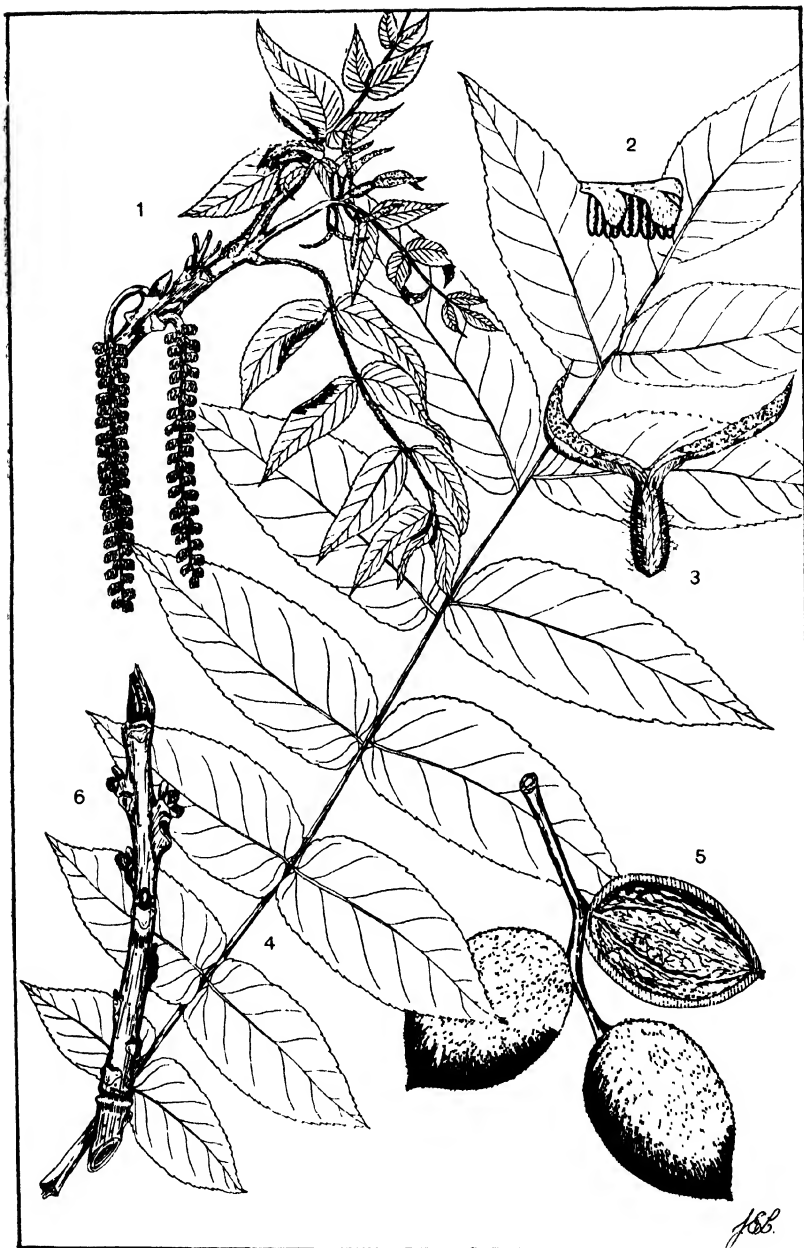
Fruit—A globose or slightly pyriform, yellowish green, indehiscent drupe, 1½—2 inches in diameter, roughened by pale hairs, frequently borne in pairs; nut ovoid and pointed or subglobose, slightly compressed, strongly and irregularly ridged, 4-celled at the base and 2-celled at the apex.

Winter characters—Twigs stout, lenticellate, dull orange-brown and pilose the first winter, gradually darkening to a light brown. Pith pale buff, diaphragmed. Leaf-scars elevated, 3-lobed (often cordate), with 3 equidistant U-shaped clusters of bundle-scars. Buds pale grayish white. Terminal bud rounded, ovate, ½ of an inch long, covered by 4 scales, the outer pair rounded and lobed, the inner pinnatifid at the apex. Lateral buds smaller, blunt, often superposed. Staminate aments preformed the preceding season, appearing as scaly, cone-like, tomentose lateral buds. Mature bark dark brown to grayish black, 2—3 inches thick, divided by deep fissures into broad, rounded ridges, thick, scaly at the surface.

Habitat—Requires a deep, rich, moist, well-drained soil. Thrives best in the deep alluvial soils of bottom-lands which contain a large amount of humus, and on fertile slopes. Occurs with other bottomland hardwoods, never in pure stands. Very intolerant.

Range—Massachusetts westward through southern Ontario, s. Wisconsin and s. Minnesota to Nebraska, south to Florida and eastern Texas.

Uses—One of the most valuable timber trees of eastern United States. Wood hard, heavy, strong, somewhat coarse-grained, easily worked, durable in contact with the soil, rich chocolate or purplish brown with thin, pale sapwood. Prized for gun stocks, furniture, interior finish and cabinet-making. Figured stock often brings very high prices. Supply greatly depleted. Nut rich in oil, nutritious, often found in the eastern markets. Black Walnut is of decided ornamental value.



Butternut, White Walnut

Juglans cinerea L.

- | | |
|---|---|
| 1. A flowering branch showing pistillate and staminate flowers $\times \frac{1}{2}$ | 4. A mature leaf $\times \frac{1}{2}$ |
| 2. A staminate flower, lateral view $\times \frac{1}{2}$ | 5. A fruit-cluster $\times \frac{1}{2}$ |
| 3. A pistillate flower, lateral view $\times \frac{2}{3}$ | 6. Winter twig $\times \frac{1}{2}$ |

JUGLANDACEAE

Juglans cinerea L.

Butternut, White Walnut

Habit—Usually a medium sized tree 30—50 feet in height, with a short stout trunk 1—2 feet in diameter which divides 15—20 feet above the ground into several stout, wide-spreading limbs. Crown broad, unsymmetrical, round-topped and rather open. Under optimum conditions the tree may attain a height of 100 feet with a tall, stout, straight bole which is free of branches for half its length. Maturity is reached in about 50 years.

Leaves—Alternate, odd-pinnately compound, 15—30 inches long, consisting of 11—19 sessile or nearly sessile leaflets arranged in pairs or suboppositely along a stout, glandular-pubescent rachis, the terminal leaflet long-stalked. Leaflets oblong-lanceolate, 2—4 inches long, $1\frac{1}{2}$ —2 inches wide, acute or acuminate at the apex, inequilateral and rounded at the base, finely serrate except as the base, glandular and sticky as they unfold, at maturity thin, yellowish green and rugose above, pale and soft pubescent beneath.

Flowers—Appearing in May or early June when the leaves are about half grown, monoecious, the staminate in stout, unbranched, elongated aments 2—3 $\frac{1}{4}$ inches long borne on the growth of the preceding season, the pistillate in terminal, 5—8-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers about $\frac{1}{4}$ of an inch long, epaulet-shaped, consisting of a rusty-pubescent, acute bract bearing in its axil a 6-lobed, light yellowish green perianth subtending 8—12 nearly sessile stamens; anthers dark brown. Pistillate flowers about $\frac{1}{4}$ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by a short style and 2 clavate, spreading, bright red stigmas nearly half an inch in length. The ovary is closely invested by glandular, adhering bracts and the calyx.

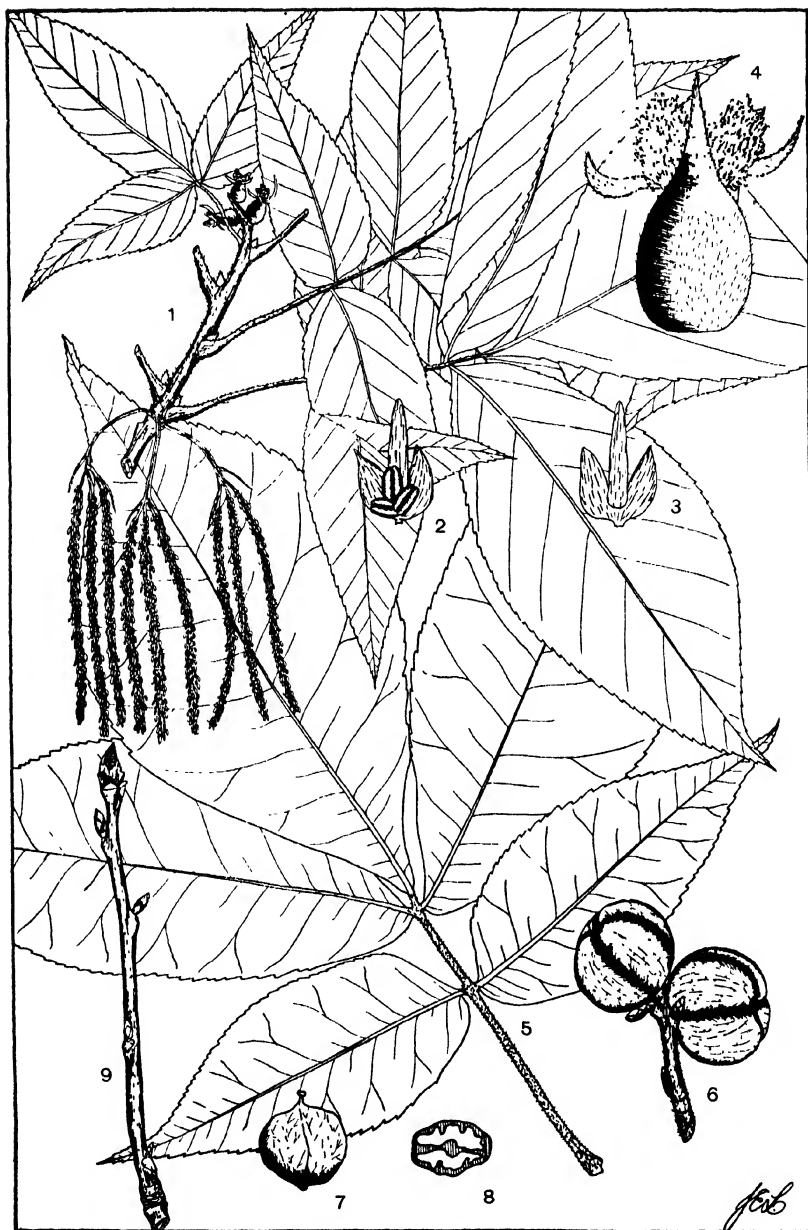
Fruit—An ovoid-oblong, yellowish green, clammy-pubescent drupe $1\frac{1}{2}$ —2 $\frac{1}{2}$ inches long, borne in clusters of 2—5; nut ovoid-oblong, abruptly acute at the apex, 8-ridged (4 prominent ridges) and sculptured, thick-shelled, 2-celled at the base and 1-celled at the apex.

Winter characters—Twigs stout, lenticellate, greenish gray to reddish buff and lustrous the first winter, turning reddish or orange-brown the second season, at length gray. Pith dark brown, diaphragmed. Leaf-scars elevated, obcordate, hairy fringed on the upper margin, with 3 equidistant U-shaped clusters of bundle-scars. Terminal buds truncate, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, the outer scales lobed. Lateral buds smaller, ovate, blunt, often superposed. Staminate catkins preformed the preceding season, appearing as scaly, cone-like, lateral buds. Mature bark light gray, $\frac{3}{4}$ —1 inch thick, divided by deep fissures into broad ridges scaly on the surface.

Habitat—Prefers rich, moist limestone soils. Frequent along fences and roads, stream courses, in pastures and low moist woods, and on rocky hills. Occurs as a scattered tree in open mixtures with Basswood, Yellow Poplar, Cherry, Hickories, etc. Requires full light to survive.

Range—New Brunswick and Quebec westward through Ontario to eastern South Dakota, southward in the East to Delaware and in the mountains to Georgia and Alabama, in the West extending southward to northern Arkansas.

Uses—Not an important timber species. Wood light, soft, weak, rather coarse-grained, easily worked and polished, light brown darkening with exposure, with thin, pale sapwood. Used occasionally for interior and cabinet work, furniture, instrument cases, etc. The oily and nutritious nuts could no doubt be greatly improved by selection. The bark and husk of the nuts contain a yellow dye.



Shagbark Hickory, Shellbark Hickory

Carya ovata (Mill.) K. Koch. [*Hicoria ovata* (Mill.) Britt.;
Carya alba Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times 5$
3. A staminate flower, distal view $\times 5$
4. A pistillate flower, lateral view $\times 6$
5. A mature leaf $\times \frac{1}{2}$
6. A twig with fruit $\times \frac{1}{2}$
7. Nut $\times \frac{1}{2}$
8. Cross section of the nut $\times \frac{1}{2}$
9. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya ovata (Mill.) K. Koch. [*Hicoria ovata* (Mill.) Britt.;
Carya alba Nutt.]

Shagbark Hickory,* Shellbark Hickory

Habit—A tree at maturity attaining a height of 60—90 feet with a trunk diameter of 2—3 feet, under optimum conditions sometimes 120 feet tall. Crown in the open usually irregular and open, narrowly oblong-cylindrical. In the forest the bole is typically columnar, bearing aloft a small open crown. The tree develops a deep tap-root. An age of 250 years is not infrequently attained.

Leaves—Alternate, odd-pinnately compound, 8—14 inches long, consisting of 5—7 (usually 5) sessile or nearly sessile leaflets arranged in pairs along a stout, glabrous or pubescent, slightly grooved rachis, the lower pair the smallest and the terminal leaflet narrowed into a stalk. Leaflets ovate-lanceolate to obovate, 4—6 inches long, acuminate at the apex, inequilateral at the base, serrate and densely ciliate except near the base, at maturity thin, firm, dark yellowish green and glabrous above, pale, glabrous or puberulous below.

Flowers—Appearing in May and early June after the unfolding of the leaves, monoecious, the staminate in slender, light green, drooping catkins 4—5 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season, rarely at the base of the growth of the season, the pistillate in terminal, 2—5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers pedicellate, glandular-hirsute without, about $\frac{1}{8}$ of an inch long, consisting of an elongated, ovate-lanceolate bract and 2 ovate, concave calyx-lobes bearing axially 3—4 stamens. Pistillate flower about $\frac{1}{2}$ of an inch long, sessile consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, pale green, papillate stigmas.

Fruit—Solitary or in pairs, subglobose to slightly obovoid, 1—2½ inches long, 4-channeled from apex to base, at maturity dark reddish brown or nearly black, lenticellate, glabrous or pilose. Husk thick, splitting to the base. Nut white, rather thin-shelled, usually ellipsoid to broad-obovoid but very variable in form, pointed at the apex, rounded at the base, more or less compressed. 4 angled or ridged, $\frac{3}{4}$ —1¼ inches long, with large, light brown, sweet kernel.

Winter characters—Twigs stout, usually somewhat pubescent, reddish brown or grayish. Leaf-scars slightly elevated, inversely triangular to oblong, with scattered bundle-scars. Terminal bud broadly ovate, dark brown, $\frac{1}{2}$ —¾ of an inch long, the outer scales loose and pubescent on the outer surface, often keeled and projecting above into a point, persisting through the winter. Lateral buds smaller. Mature bark light gray, $\frac{3}{4}$ —1 inch thick, separating into rough strips or plates.

Habitat—Prefers deep, moist but not wet soils. Common and of its largest size on the rich alluvial soils of the lower Ohio Basin. Occurs in mixture with Basswood, Maples, Cottonwoods, Oaks, Hickories, etc., rarely in pure stands.

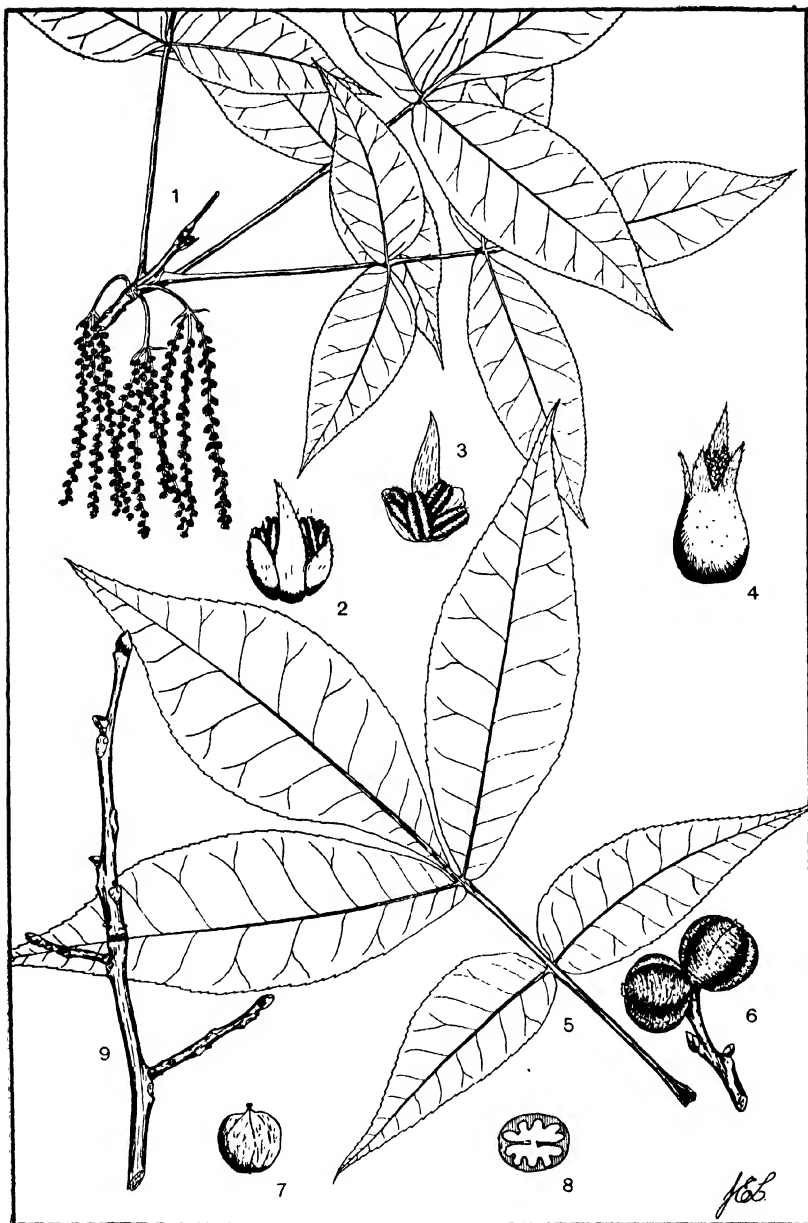
Range—Southern Quebec and Ontario, Maine to Minnesota, south to northern Florida and eastern Texas.

Uses—One of the most valuable hickories, producing excellent hickory stock. Wood heavy, very hard and strong, tough, elastic, close-grained, light brown with nearly white sapwood. This tree produces the common hickory nut of commerce.

* (a) A variety of this species, *Carya ovata* var. *fraxinifolia* Sarg. [*Hicoria ovata* var. *fraxinifolia* (Sarg.) Sudw.] has been reported by Sargent as occurring near Rochester, N. Y., near Kingston, Canada, and westward to Iowa and Oklahoma: the leaves are smaller (7—9 inches long), the leaflets narrower (lanceolate to oblong-lanceolate), and the fruit more distinctly obovoid.

(b) Var. *ellipsoidal* Sarg. [*Hicoria ovata* var. *ellipsoidal* (Sarg.) Ashe], with ellipsoidal, much compressed, long-pointed nuts, has also been described from near Rochester, N. Y.

(c) The Little-nut Hickory, *Carya ovata* var. *nuttallii* Sarg., sometimes considered as a separate species, is described on the following page.



Little nut Shagbark Hickory

Carya ovata var. *nuttallii* Sarg. [*Carya microcarpa* Nutt. in part;
Hicoria ovata var. *nuttallii* (Sarg.) Ashe]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. A staminate flower, distal view $\times 5$
3. A staminate flower, proximal view $\times 5$
4. A pistillate flower, lateral view $\times 5$
5. A mature leaf $\times \frac{1}{2}$
6. A twig-tip with fruit $\times \frac{1}{2}$
7. Nut $\times \frac{1}{2}$
8. Cross section of the nut $\times \frac{1}{2}$
9. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya ovata var. *nuttallii* Sarg. [*Carya microcarpa* Nutt. in part;
Hicoria ovata var. *nuttallii* (Sarg.) Ashe]

Littlenut Shagbark Hickory

Habit—A tree at maturity attaining a height of 50—80 feet with a trunk diameter of 2—3 feet, under optimum conditions sometimes 100 feet tall. Crown narrowly oblong with rather short, spreading branches, the lower mostly pendulous. Bole continuous into the crown, sometimes forked.

Leaves—Alternate, odd-pinnately compound, 8—12 inches long, consisting of 5—7 (generally 5), sessile or nearly sessile leaflets arranged in pairs along a stout, smooth, slightly grooved rachis, the terminal leaflet narrowed into a stalk. Leaflets ovate-lanceolate to oblong, 3—5 inches long, 1—2 inches broad, acuminate at the apex, rounded and usually inequilateral at the base, sharply serrate except at the base, at maturity thick, firm, dark yellowish green and shining above, paler and glabrous below.

Flowers—Appearing in May and June after the unfolding of the leaves, monoecious, the staminate in slender drooping catkins 3—6 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal 2—5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flower short-pedicellate, somewhat pubescent, about $\frac{1}{8}$ of an inch long, consisting of an ovate-lanceolate bract and two calyx-lobes bearing axially 4 stamens. Pistillate flowers about $\frac{3}{4}$ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, yellowish green stigmas. The ovary is invested by the adhering, pale green involucre.

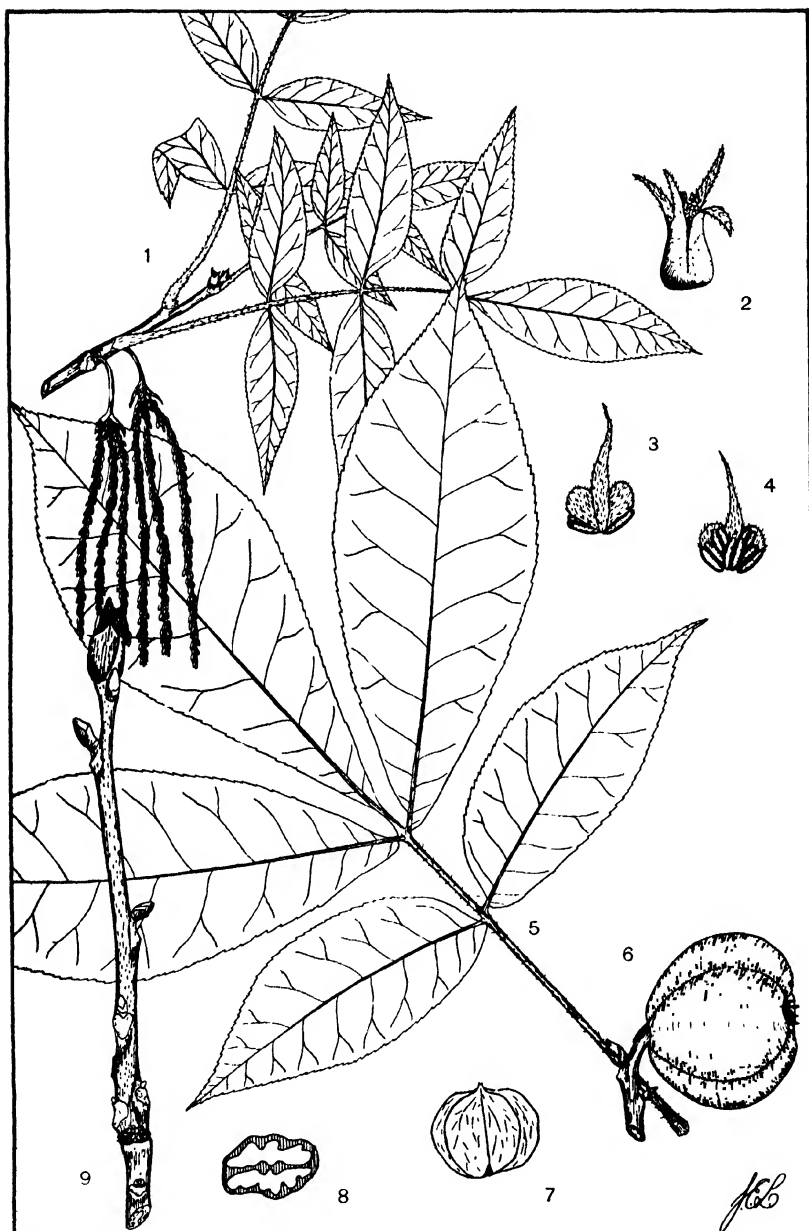
Fruit—Subglobose, $\frac{1}{2}$ —1 inch long, 4-channeled from apex to base, light brown and scaly at maturity. Husk thick, splitting tardily but completely to the base. Nut brownish white, thin-shelled, subglobose, sharp pointed, much compressed and angled, about $\frac{1}{2}$ of an inch long, with small, sweet kernel.

Winter characters—Twigs rather slender, pale-lenticellate, smooth and lustrous, light brown turning dark red the second season. Leaf-scars bluntly and inversely triangular, the bundle-scars in clusters in the lobes. Terminal bud reddish brown and lustrous, ovoid, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long, the scales imbricated and close-fitting. Mature bark thin, at first close and shallowly furrowed, at length shaggy with thin plates.

Habitat—An upland species preferring the same sites as Shagbark Hickory from which it frequently is not distinguished.

Range—Central New England west through New York, southern Ontario and Michigan to Iowa, south to Georgia and Missouri.

Uses—Wood similar to that of Shagbark Hickory and put to similar uses. Nuts sweet but too small for general commercial exploitation.



Bigleaf Shagbark Hickory, Big Shellbark Hickory, Kingnut
Carya laciniosa (Michx. f.) Loud. [*Hicoria laciniosa* (Michx. f.) Sarg.;
Carya sulcata Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x $\frac{1}{2}$
2. A pistillate flower, lateral view x $2\frac{1}{2}$
3. A staminate flower, distal view x 8
4. A staminate flower, proximal view x 8
5. A mature leaf x $\frac{1}{2}$
6. A twig with fruit x $\frac{1}{2}$
7. Nut x $\frac{1}{2}$
8. Cross section of the nut x $\frac{1}{2}$
9. Winter twig x $\frac{1}{2}$

JUGLANDACEAE

Carya laciniosa (Michx. f.) Loud. [*Hicoria laciniosa* (Michx. f.) Sarg.;
Carya sulcata Nutt.]

Bigleaf Shagbark Hickory, Big Shellbark Hickory, Kingnut

Habit—Similar in gross characteristics to the Shagbark Hickory. A tree 50–90 feet in height with a trunk diameter of 2–3 feet, occasionally 120 feet tall. Crown narrowly oblong to subovoid, consisting of rather short lateral branches which extend in the open to within 8–10 feet of the ground. Lower branches pendulous. Under forest conditions the bole is tall, straight, and columnar and is often free of branches for half its length, bearing aloft a reduced crown.

Leaves—Alternate, odd pinnately compound, 15–22 inches long, consisting of 5–9 (usually 7) sessile or nearly sessile leaflets arranged in pairs along a stout, glabrous or pubescent, flattened, grooved rachis, the lower pairs the smaller and the terminal leaflet narrowed into a stalk. Leaflets ovate to oblong-lanceolate or broadly obovate, the 3 upper usually obovate, 5–9 inches long, acuminate at the apex, rounded and generally inequilateral at the base, ciliate and finely serrate except near the base, at maturity thin, firm, dark green and somewhat lustrous above, pale yellowish green or bronze-brown and soft pubescent beneath.

Flowers—Appearing in May and early June after the unfolding of the leaves, monoecious, the staminate in slender, light green, drooping catkins 5–8 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season, rarely at the base of the growth of the season, the pistillate in terminal, 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers pedicellate, rufous-tomentose without, about $\frac{1}{8}$ of an inch long, consisting of a linear-lanceolate, acute bract and 2 rounded calyx-lobes bearing axially 3–5 stamens; anthers yellow, nearly sessile. Pistillate flowers about $\frac{1}{2}$ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, pale green, papillate stigmas. The ovary is invested by the perianth-like, adhering, pale-tomentose involucre.

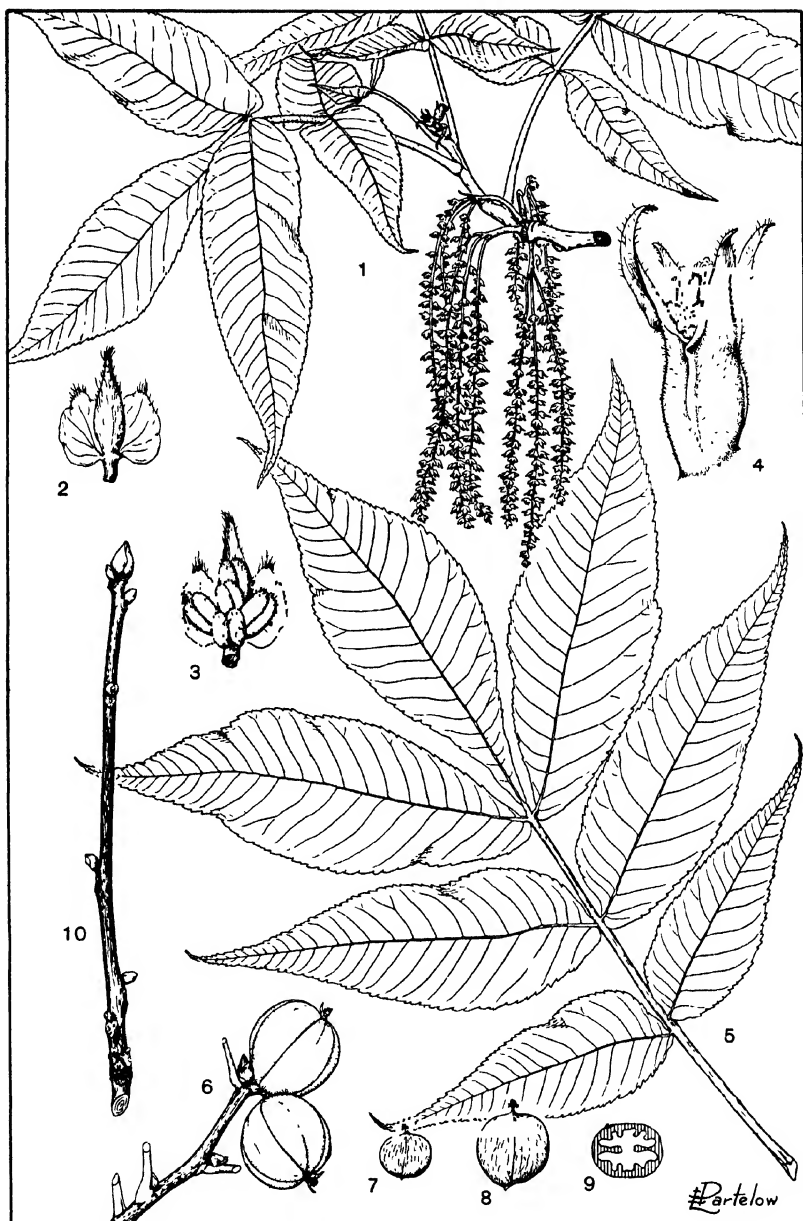
Fruit—Solitary or in pairs, ellipsoid, ovoid, or subglobose, $1\frac{3}{4}$ – $2\frac{1}{2}$ inches long, 4-channeled at least above the middle, at maturity light orange-colored to dark chestnut-brown, glabrous or pubescent, orange-lenticellate. Husk thick, splitting to the base. Nut yellowish, thick-shelled, usually ellipsoidal but very variable, pointed at the ends, compressed, 4-ridged or -angled or often 6-ridged, with large, light brown, sweet kernel.

Winter characters—Twigs stout, orange-lenticellate, usually somewhat pubescent, orange-brown turning to ashy gray the second winter. Leaf-scars slightly elevated, inversely triangular, the upper margin indented. Terminal bud ovate, dark brown, $\frac{3}{4}$ –1 inch long, the outer scales rather loose and pubescent on the outer surface and often keeled and long pointed at the apex. Lateral buds much smaller. Mature bark light gray, 1–2 inches thick, separating into broad, thick plates which persist on the tree for a number of years giving the trunk a shaggy appearance.

Habitat—Distinctly a bottom-land tree, preferring rich soils which are often inundated for several months in the spring. Occasional on fertile uplands. This species is more gregarious than *C. ovata* which it resembles, often making up 50% of the stand.

Range—Central New York through southern Ontario and s. Ohio to southeastern Iowa, Nebraska and Oklahoma, southward in eastern Pennsylvania to western West Virginia, southeastern Tennessee, Alabama and Louisiana.

Uses—Among the most valuable of the hickories as a source of timber. Wood similar to that of Shagbark Hickory and usually not distinguished in the trade. Nuts often found in the eastern markets, larger than those of the Shagbark Hickory but not as finely flavored.



False Pignut Hickory, Small-fruited Hickory

Carya ovalis (Wangh.) Sarg. [*Hicoria ovalis* (Wangh.) Sudw.;

Carya microcarpa Nutt. in part; *Hicoria microcarpa* (Nutt.) Britt.]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. A staminate flower, distal view $\times 5$
3. A staminate flower, proximal view $\times 5$
4. A pistillate flower, lateral view $\times 5$
5. A mature leaf $\times \frac{1}{2}$
6. A twig-tip with fruit $\times \frac{1}{2}$
- 7 and 8. Nuts showing variation in size in this species $\times \frac{1}{2}$
9. Cross section of a nut $\times \frac{1}{2}$
10. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya ovalis (Wangh.) Sarg. [*Hicoria ovalis* (Wangh.) Sudw.;
Carya microcarpa Nutt. in part; *Hicoria microcarpa* (Nutt.) Britt.]

False Pignut Hickory,* Small-fruited Hickory

Habit—A tree usually 50–80 feet in height with a trunk diameter of 15–24 inches, under optimum conditions sometimes 100 feet tall with a trunk 3 feet in diameter. Crown narrow, pyramidal, composed of slender branchlets.

Leaves—Alternate, more or less fragrant, odd-pinnately compound, 6–10 inches long, consisting of 7 (rarely 5) sessile leaflets arranged in pairs along a slender, essentially glabrous, often glandular, reddish rachis, the terminal leaflet narrowed into a stalk. Leaflets lanceolate to oblanceolate or occasionally obovate, the terminal leaflet 6–7 inches long and $1\frac{1}{2}$ –2 inches wide, those of the upper pairs as large or nearly as large as the terminal leaflet, long-pointed and acuminate or rarely rounded at the apex, cuneate and unsymmetrical at the base, at maturity thick, firm, dark yellowish green and glabrous above, paler, yellow-glandular and essentially glabrous below. The midribs of the leaflets, like the rachis, are reddish, and the common name, Red Hickory, has been suggested for this species.

Flowers—As in Pignut (which see), the staminate aments 6–7 inches long, the pistillate flowers in terminal, 1–2-flowered spikes. Staminate flowers short-pedicellate, pubescent, about $\frac{1}{8}$ th of an inch long, consisting of a lanceolate bract and 2 broadly ovate calyx-lobes bearing axially 4–5 stamens; anthers nearly sessile, yellow, thickly covered with pale hairs. Pistillate flowers about $\frac{1}{8}$ th of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, greenish yellow stigmas. The ovary is invested by the adhering, glandular, somewhat pubescent, pale green involucre.

Fruit—Ellipsoidal, acute or rounded at the apex, rounded at the base, $1\frac{1}{4}$ –1 inches long, $\frac{3}{4}$ ths of an inch in diameter, 4-sutured from apex to base, at maturity reddish brown and puberulous. Husk thin ($\frac{1}{16}$ th– $\frac{1}{8}$ th of an inch in thickness), splitting freely to the base. Nut pale brownish white, oblong, slightly flattened, acute or acuminate and 4-angled at the apex, rounded at the base. Shell rarely more than $\frac{1}{4}$ th of an inch in thickness. Seed small and sweet.

Winter characters—Twigs similar to those of Pignut (which see). Terminal bud often $\frac{1}{2}$ of an inch long; outer scales reddish brown, lustrous, glabrous; inner scales covered with close pale tomentum. Lateral buds not over half the length of the terminal bud but otherwise similar, strongly divergent. Mature bark slightly ridged, pale gray, usually separating freely into small, plate-like scales, occasionally close.

Habitat—An upland species preferring hillsides and rich woods, often in admixture with other hardwoods. Frequently confused with Pignut, *Carya glabra* (Mill.) Sweet.

Range—Western New York, eastern Pennsylvania and the District of Columbia to southern Illinois and central Iowa, southward to the mountains of North Carolina and Tennessee, and to central Georgia and Alabama.

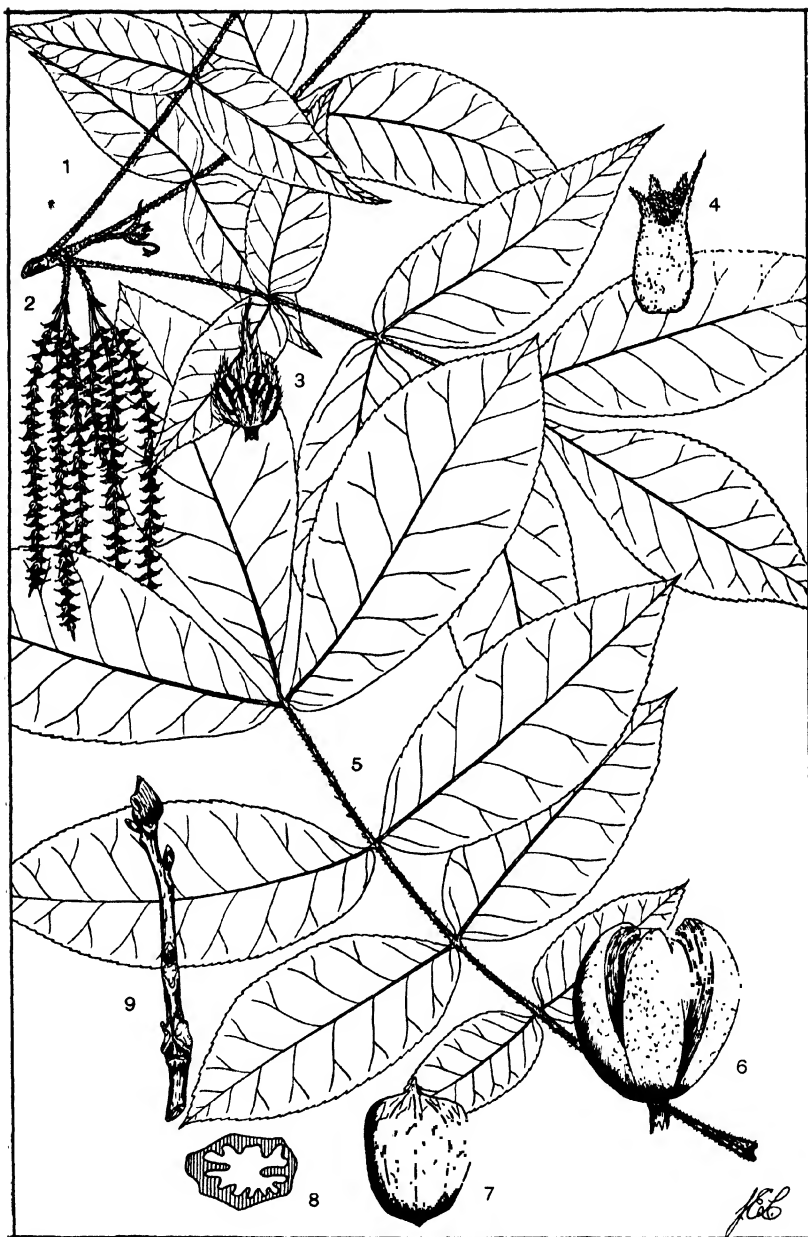
Uses—Wood heavy, hard, very strong, tough and elastic. Not distinguished in the trade from the woods of the other 'true' hickories. The nuts are small but are occasionally eaten.

*A number of varieties of *Carya ovalis* Sarg are distinguished, differing in the shape of the fruit, of which the following deserve mention here.

1. *Carya ovalis* var. *obcordata* (Muhl. et Willd.) Sarg. [*Hicoria ovalis* var. *obcordata* (Muhl. et Willd.) Sudw.]; fruit subglobose to short oblong or slightly obovoid, $1\frac{1}{4}$ –1 inches in diameter, with a husk $\frac{1}{12}$ – $\frac{1}{8}$ th of an inch in thickness, splitting to or nearly to the base. The common and most widely distributed variety of *Carya ovalis*.

2. *Carya ovalis* var. *odorata* (Sarg.) Sarg. [*Hicoria ovalis* var. *odorata* (Sarg.) Sudw.]; fruit subglobose to short oblong, longer than broad, much flattened, $\frac{1}{2}$ – $\frac{3}{5}$ ths of an inch in diameter, with a very thin husk ($\frac{1}{24}$ th of an inch in thickness), splitting freely to the base; nut compressed, rounded at the apex, rounded or acute at the base, slightly or not at all ridged.

3. *Carya ovalis* var. *obovata* Sarg. [*Hicoria ovalis* var. *obovata* (Sarg.) Sudw.]; fruit more or less obovoid, about 1 inch long and $\frac{4}{5}$ ths of an inch in diameter, with a husk $\frac{1}{12}$ th– $\frac{1}{8}$ th of an inch in thickness, splitting freely to the base.



Mockernut

Carya tomentosa Nutt. [*Carya alba* (L.) K. Koch, not L.;
Hicoria alba (L.) Britt.]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. Pedunculate clusters of staminate aments $\times \frac{1}{2}$
3. A staminate flower, proximal view $\times 5$
4. A pistillate flower, lateral view $\times 6$
5. A mature leaf $\times \frac{1}{2}$
6. A fruit $\times \frac{1}{2}$
7. Nut $\times \frac{1}{2}$
8. Cross section of the nut $\times \frac{1}{2}$
9. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya tomentosa Nutt. [*Carya alba* (L.) K. Koch, not L.;
Hicoria alba (L.) Britt.]

Mockernut

Habit—A tree usually 50—80 feet in height with a trunk diameter of 2—3 feet, under optimum conditions sometimes 100 feet tall. In the forest the crown is narrowly oblong and reduced, extending down about half way on the clean, straight bole. Trees in the open usually develop a broad, open, rather ragged crown.

Leaves—Alternate, characteristically fragrant when crushed, odd-pinnately compound, 8—12 inches long, consisting of 7—9 (rarely 5) sessile or nearly sessile leaflets arranged in pairs along a rather stout, pubescent, flattened, grooved rachis, the lower pairs gradually reduced in size and the terminal leaflet narrowed into a stalk. Leaflets oblong-lanceolate or obovate-oblong, 3—7 inches long, acuminate at the apex, somewhat rounded and inequilateral at the base, serrate, at maturity rather thin, dark green and lustrous above, pale orange-brown, densely pubescent and glandular below.

Flowers—Appearing in May and early June when the leaves are about half grown, monoecious the staminate in slender, yellowish green, drooping catkins 4—5 inches in length which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal, 2—5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short-pedicellate, pale yellowish green, $\frac{1}{8}$ — $\frac{1}{6}$ of an inch long, consisting of an ovate-lanceolate bract and 2 rounded calyx-lobes bearing axially 4 stamens; anthers bright red and nearly sessile. Pistillate flowers about $\frac{1}{3}$ of an inch long, sessile, consisting of an inferior 1-celled ovary surmounted by 2 sessile, spreading, dark red stigmas. The ovary is invested by the greenish, tomentose, perianth-like involucre.

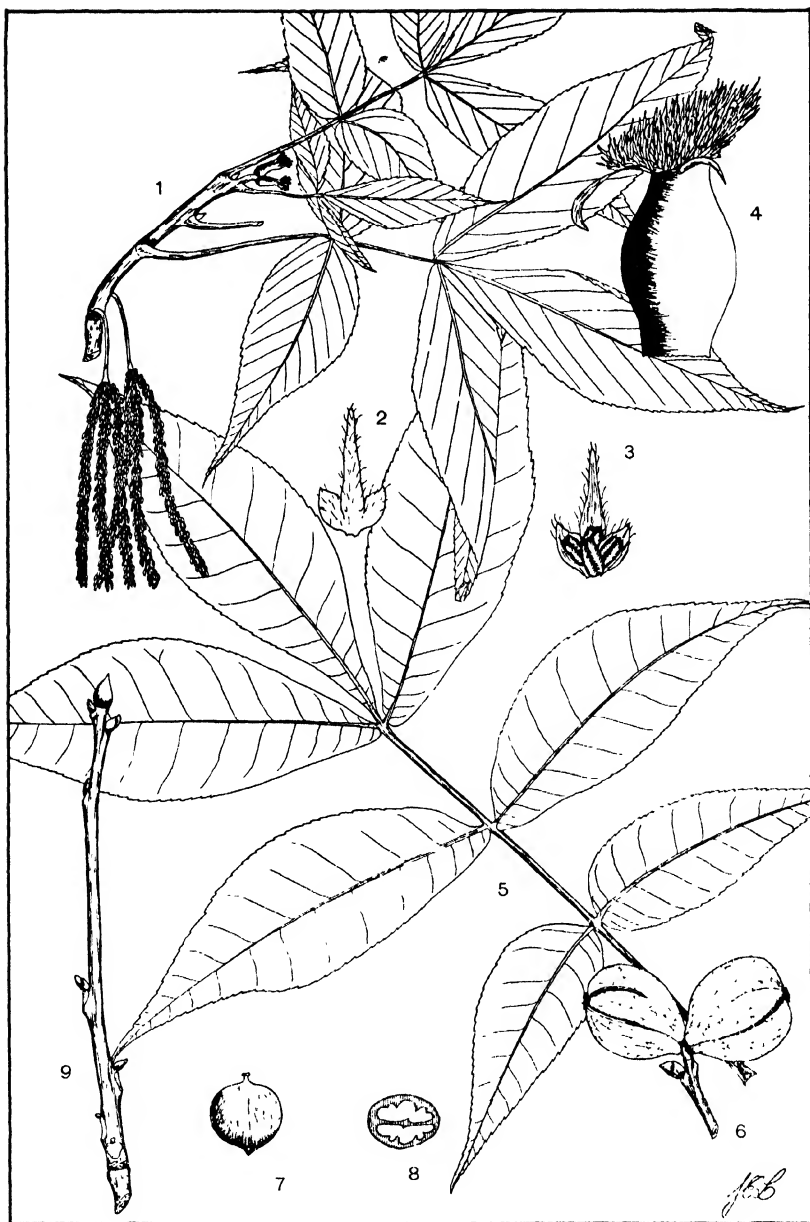
Fruit—Ellipsoidal to obovoid, $1\frac{1}{2}$ —2 inches in length, 4-channeled from apex to base, at maturity dark reddish brown, lenticellate, nearly glabrous. Husk thick, splitting to the middle or nearly to the base. Nut pale reddish brown, very thick-shelled, obovoid-oblong or ovoid (very variable in shape), acute or acuminate, more or less compressed, 4-ridged toward the apex, with small, dark brown, sweet kernel.

Winter characters—Twigs very stout, pale-lenticellate, pubescent, reddish brown turning gray the second season. Leaf-scars inversely 3-lobed, the bundle-scars in marginal clusters. Terminal bud broadly ovate to spherical, reddish brown or yellowish, $\frac{1}{3}$ — $\frac{1}{4}$ of an inch long; outer scales soon falling off entire exposing the pale yellowish gray, silky scales beneath. Lateral buds much smaller. Mature bark gray, rather thin, shallowly fissured, close-scaly.

Habitat—Prefers dry slopes and ridges, less commonly on alluvial bottomlands. Found in mixture with Oaks, Tulip Poplar, Sassafras, Black Birch, etc.

Range—Massachusetts west through central New York and southern Ontario to eastern Kansas, south to Florida and Texas. Rare in the North.

Uses—Produces the best grade of hickory stock. Wood hard, strong, heavy, tough and elastic, dark brown with thick sapwood. Used similarly as the woods of the other 'true' hickories. Nuts occasionally found in the eastern markets.



Pignut

Carya glabra (Mill.) Sweet [*Hicoria glabra* (Mill.) Britt.;

Carya porcina Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. A staminate flower, distal view $\times 5$
3. A staminate flower, proximal view $\times 5$
4. A pistillate flower, lateral view $\times 6$
5. A mature leaf $\times \frac{1}{2}$
6. A twig-tip with fruit $\times \frac{1}{2}$
7. Nut $\times \frac{1}{2}$
8. Cross section of nut $\times \frac{1}{2}$
9. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya glabra (Mill.) Sweet [*Hicoria glabra* (Mill.) Britt.;

Carya porcina Nutt.]

Pignut*

Habit—A tree at maturity attaining a height of 80–90 feet with a trunk diameter of 2–3 feet, occasionally 120 feet in height. Crown oblong, rather narrow, consisting of short, spreading branches, the lower somewhat pendulous. Bole tall, slender, tapering, often free of lateral branches for some distance, occasionally forked.

Leaves—Alternate, odd-pinnately compound, 8–12 inches long, consisting of 3–7 (generally 5) sessile leaflets arranged in pairs along a slender, glabrous, slightly grooved rachis, the terminal leaflet narrowed into a stalk. Leaflets lanceolate to obovate-oblong, 3–6 inches long, acuminate at the apex, rounded and usually inequilateral at the base, sharply serrate except at the base, at maturity thick, firm, dark yellowish green and glabrous above, paler, glabrous or pubescent on the midrib below.

Flowers—Appearing in May and June after the unfolding of the leaves, monoecious, the staminate in slender drooping catkins 3–7 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short-pedicellate, pale tomentose, about $\frac{1}{8}$ of an inch long, consisting of an ovate or lanceolate bract and 2 calyx-lobes bearing axially 4 stamens; anthers nearly sessile, orange-colored. Pistillate flowers about $\frac{1}{4}$ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, greenish yellow stigmas. The ovary is invested by the adhering, glabrous or pubescent, pale green involucre.

Fruit—Obovoid, about 1 inch long, rounded at the apex, gradually narrowed below, wing-sutured at least above the middle, at maturity reddish brown and often pubescent. Husk thin, opening rather tardily to the middle or sometimes enclosing the nut after it has fallen. Nut brownish white, thick-shelled, obovoid to subglobose, compressed, without ridges, with light brown, usually astringent kernel.

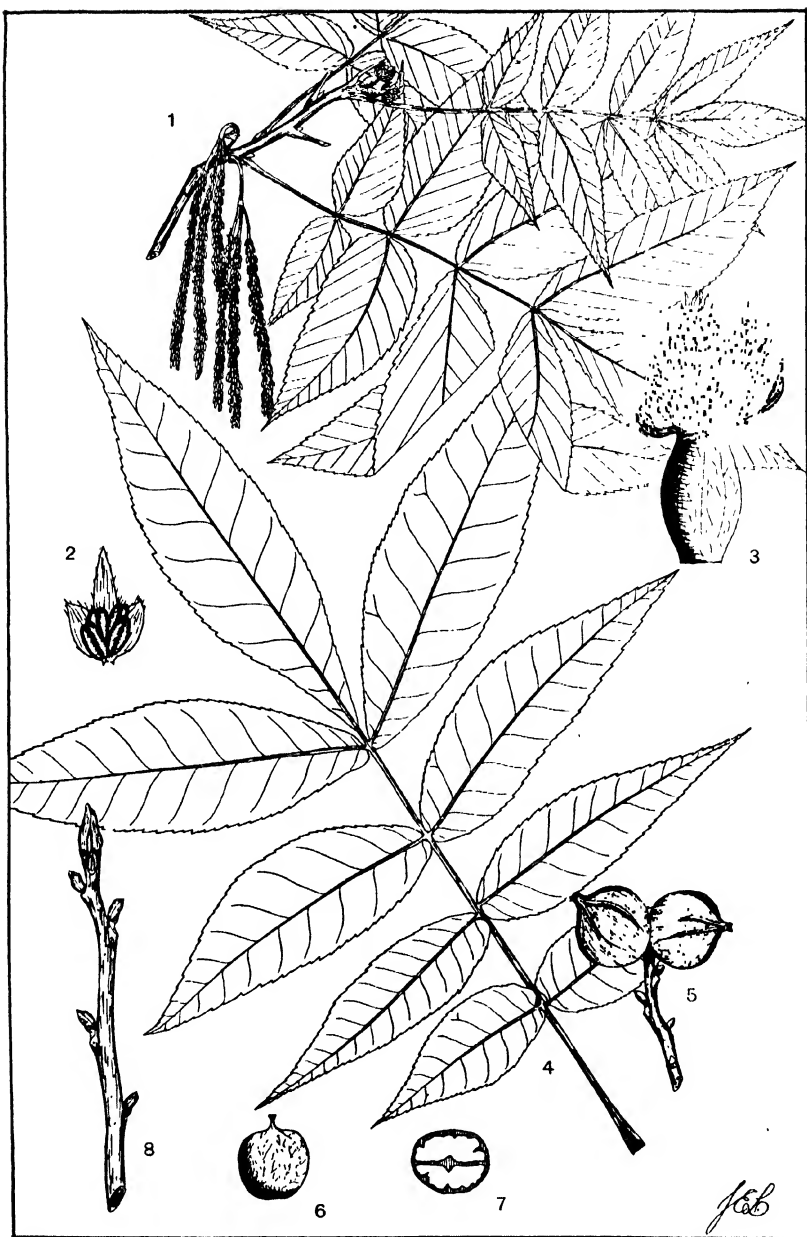
Winter characters—Twigs rather slender, pale-lenticellate, smooth and lustrous, light reddish brown turning grayish the second season. Leaf-scars bluntly and inversely triangular, slightly indented above, rather small. Terminal bud reddish brown and lustrous, ellipsoidal, $\frac{1}{3}$ – $\frac{1}{2}$ of an inch long, the scales rather close-fitting. Lateral buds much smaller. Mature bark thin, close, light gray, with shallow fissures separating narrow ridges, never shaggy.

Habitat—An upland species preferring dry ridges and hillsides, often in admixture with other Hickories, Oaks, Chestnut, Ashes, Cherry, etc.

Range—Southwestern Vermont through southern Ontario and s. Michigan to s. Illinois, southward to Florida, Alabama, and Mississippi.

Uses—Produces a valuable grade of hickory timber. Wood heavy, hard, very strong, tough, elastic, close-grained. Used for the same purposes as the woods of the other 'true' hickories, for wheels, tool handles, etc. Nuts very variable in flavor and frequently bitter.

*A variety of this species, *Carya glabra* var. *megacarpa* Sarg., is widely distributed in eastern United States with stations at Rochester and Syracuse, N. Y. This has fruits up to 2 inches in length which are more strikingly pyriform, with a thicker husk which opens earlier in the autumn.



Bitternut Hickory

Carya cordiformis (Wang.) K. Koch. [*Hicoria cordiformis* (Wang.) Britt.; *Hicoria minima* (Marsh.) Britt.; *Carya amara* Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers $\times \frac{1}{2}$
2. A staminate flower, proximal view $\times \frac{5}{7\frac{1}{2}}$
3. A pistillate flower, lateral view \times
4. A mature leaf $\times \frac{1}{2}$
5. A twig-tip with fruit $\times \frac{1}{2}$
6. Nut $\times \frac{1}{2}$
7. Cross section of the nut $\times \frac{1}{2}$
8. Winter twig $\times \frac{1}{2}$

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch. [*Hicoria cordiformis* (Wang.) Britt.; *Hicoria minima* (Marsh.) Britt.; *Carya amara* Nutt.]

Bitternut Hickory

Habit—A tree 50—60 feet in height with a trunk diameter of 1—2 feet, under optimum conditions in the southern part of its range sometimes attaining a height of 100 feet with a tall, straight, clean trunk. Crown round-topped, broadest near the top, consisting of rather slender, stiff, upright, ascending branches, under forest conditions usually much restricted in size.

Leaves—Alternate, odd-pinnately compound, 6—10 inches long, consisting of 5—9 sessile leaflets arranged in pairs along a slender, pubescent, slightly grooved rachis, the terminal leaflet narrowed into a stalk. Leaflets ovate-lanceolate to lanceolate, 4—6 inches long, $\frac{3}{4}$ —1 $\frac{1}{4}$ inches wide, acuminate at the apex, rounded or subcordate and usually inequilateral at the base, serrate except at the base, at maturity thin, firm, dark yellowish green and glabrous above, paler and pubescent below (especially along the midrib), at length nearly glabrous.

Flowers—Appearing in May or early June after the unfolding of the leaves, monoecious, the staminate in slender, drooping catkins 3—4 inches long which are borne in clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season. The pistillate in terminal, 2—10-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short-pedicellate, somewhat pubescent, about $\frac{1}{10}$ of an inch long, consisting of a rufous, ovate, acute bract and 2 calyx-lobes of the same color bearing axially 4 stamens; anthers yellow, ovate, short-stalked. Pistillate flowers about $\frac{1}{2}$ an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, pale green stigmas papillate on the stigmatic surface. The ovary is invested by the perianth-like, adhering, slightly 4-ridged, yellowish green involucre.

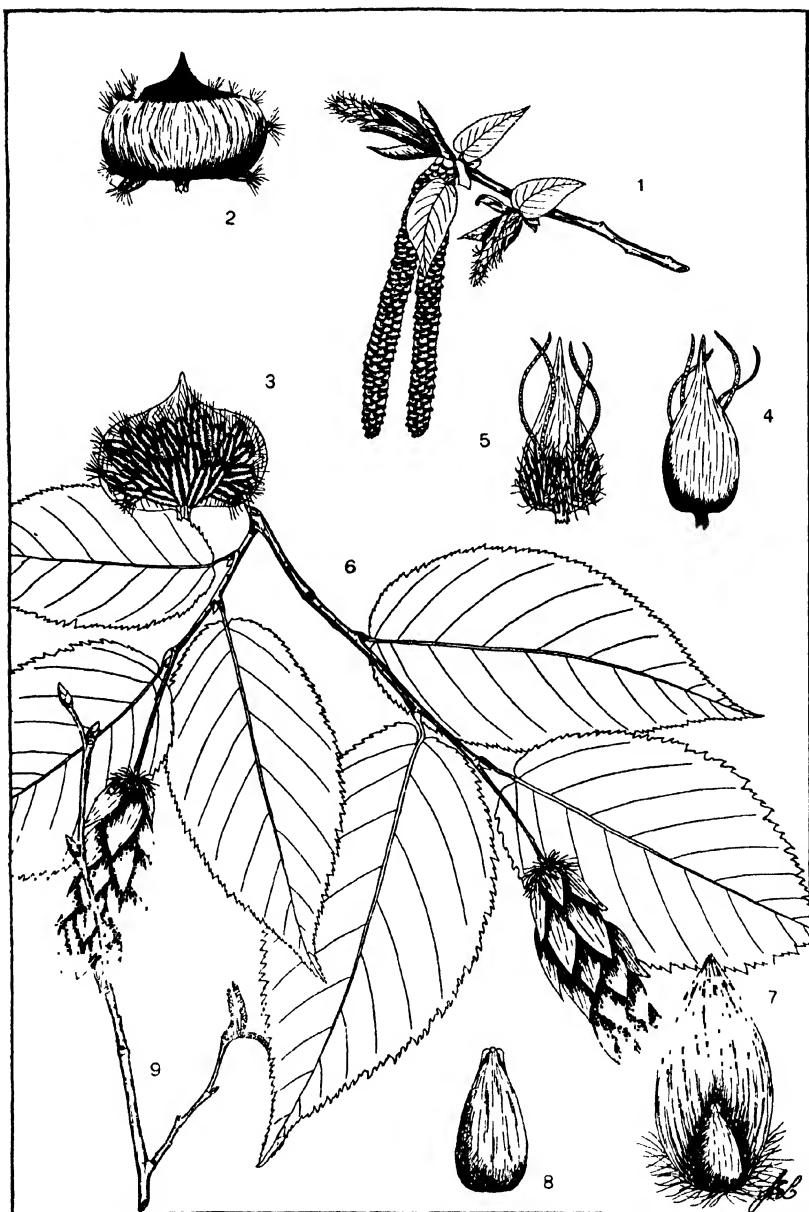
Fruit—Obovoid to subglobose, $\frac{3}{4}$ —1 $\frac{1}{2}$ inches long, 4-winged along the sutures from the apex half way to the base, greenish yellow, scurfy and pubescent. Husk thin. Nut gray, thin-shelled, subglobose to broadly ovoid, slightly compressed, smooth, abruptly pointed, with reddish brown, bitter kernel.

Winter characters—Twigs slender, lenticellate, glossy, often yellow-glandular and hairy toward the apex but smooth below, grayish or orange-brown during the first winter, at length light gray. Pith brown, angular. Leaf-scars elevated, obcordate, with 3 groups of bundle-scars. Terminal bud yellow, oblique and blunt at the apex, $\frac{1}{3}$ — $\frac{3}{4}$ of an inch long, consisting of 4 glandular scales valvate in pairs. Lateral buds smaller, somewhat 4-angled, superposed, $\frac{1}{8}$ — $\frac{3}{4}$ of an inch long, the lowest or axillary bud sessile and sharp-pointed, the upper pedunculate and angular. Mature bark light gray, $\frac{1}{3}$ — $\frac{3}{4}$ of an inch thick, close, with shallow fissures and narrow ridges, the surface peeling in small flakes.

Habitat—By preference a bottom-land tree growing on low, wet sites in pastures, fields, along sluggish streams, and in lowland deciduous forests. Very hardy, however, on poorer, drier soils. The most abundant and uniformly distributed of the Hickories.

Range—Maine through southern Quebec, Ontario, and northern Minnesota to southeastern Nebraska, south to Florida and eastern Texas.

Uses—The only member of the Pecan-Hickory group in the Northeast. A timber-species contributing a part of the hickory wood of commerce. Wood heavy, hard, strong, tough, elastic, close-grained, dark brown with paler sapwood, inferior to that of the 'true' Hickories. Valued for wagon and automobile wheels, wagon tongues, whipple-trees, tool handles, etc. Nuts bitter, not palatable.



Hop Hornbeam, Ironwood, Leverwood

Ostrya virginiana (Mill.) K. Koch. [*Ostrya virginica* Willd.]

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. A bract from staminate ament, distal view $\times 5$
3. A staminate flower with bract, proximal view $\times 5$
4. A bract from pistillate ament, distal view $\times 6$
5. Pistillate flowers with bract, proximal view $\times 6$
6. A twig showing mature leaves and fruit $\times \frac{1}{2}$
7. Vertical section of fruiting involucre showing enclosed nutlets $\times 2$
8. Nutlet $\times 3\frac{1}{2}$
9. Winter twig with staminate aments $\times \frac{1}{4}$

BETULACEAE

Ostrya virginiana (Mill.) K. Koch. [*Ostrya virginica* Willd.]

Hop Hornbeam,* Ironwood, Leverwood

Habit—At maturity a small tree usually 25—40 feet in height with a short trunk 8—15 inches in diameter, occasionally seventy feet tall. Crown rather high, open, broad, round-topped, consisting of slender branches, the lower wide-spreading and often pendulous, with fine, ascending branchlets.

Leaves—Alternate, borne on slender, terete petioles about $\frac{1}{4}$ of an inch long, ovate-oblong to ovate-lanceolate, $2\frac{1}{2}$ —5 inches long, $1\frac{1}{2}$ —2 inches wide, acuminate or acute at the apex, rounded or slightly cordate and inequilateral at the base, finely doubly serrate, at maturity thin, coriaceous, smooth and dull yellowish green above, pale green below with tufts of pale hairs in the axils of the veins.

Flowers—Appearing in April or early May with the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis reddish brown, pendent, about 2 inches long. Pistillate aments appearing with the leaves, terminal on the growth of the season, pedunculate, lax, pale green, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. The staminate flowers consist of 6—28 yellow half-anthers which are long-hairy at the apex and are raised on short, bifurcated filaments inserted on a pilose torus, the group subtended by a broadly ovate, concave scale. The pistillate flowers are borne in pairs at the base of an ovate, acute bract which persists until mid-summer, and consist of an ovary closely invested by a hairy sac-like structure formed of a bracteole and 2 secondary bractlets, a short style, and 2 long, filiform, red stigmas.

Fruit—A long-pedunculate, pendulous, creamy-white, oblong strobile, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long, $\frac{3}{8}$ —1 inch in width, consisting of ovate, acute, membranaceous, bladder-like, reticulate-venose, imbricated involucre forming a hop-like fruit. Fruiting involucre about $\frac{3}{4}$ of an inch long, slightly hairy at the apex, with sharp, stiff, stinging-hairs at the base, enclosing but much larger than the ovate, acute, flattened, chestnut-brown nutlet, at length deciduous from the strobile-axis.

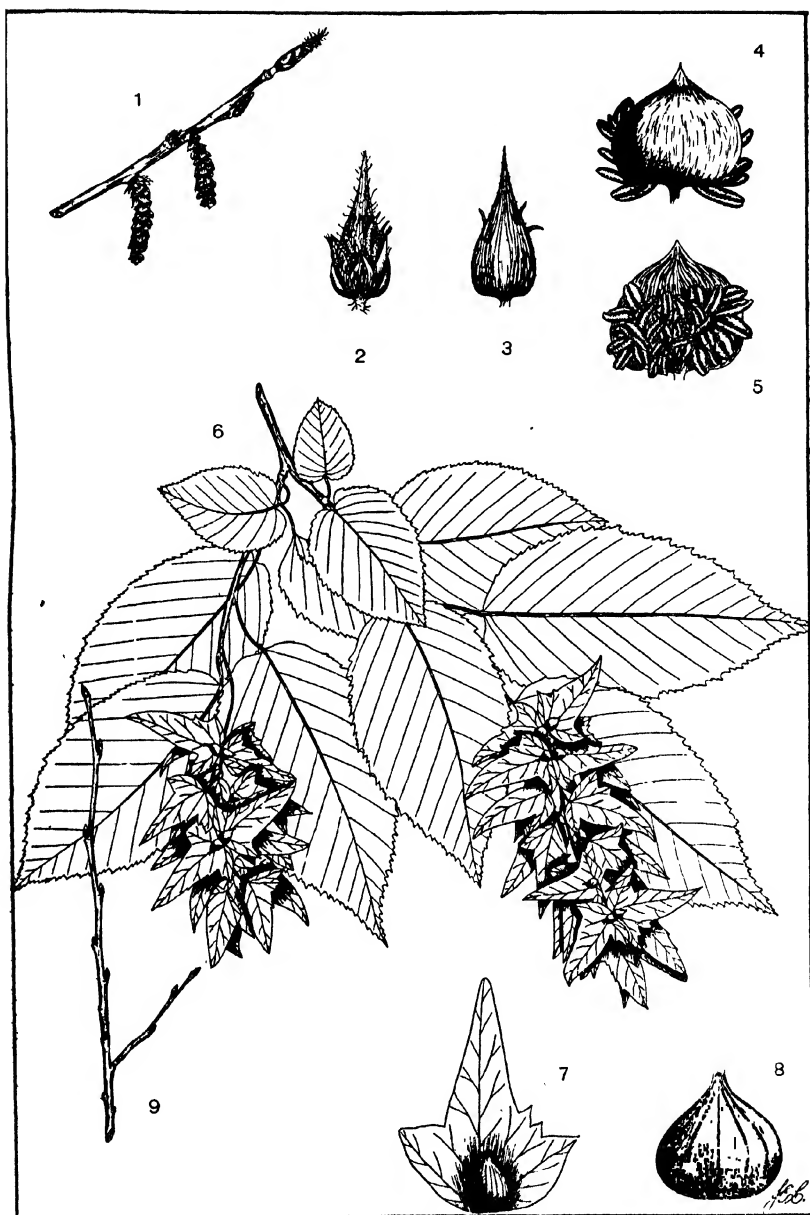
Winter characters—Twigs slender, tough, pale-lenticellate, smooth, lustrous, dark reddish brown and often zigzag, becoming dull and darker the second year. Terminal bud absent. Lateral buds ovate, acute, slightly puberulous, divergent, light chestnut-brown, about $\frac{1}{4}$ of an inch long. Mature bark light grayish brown, thin, consisting of narrowly oblong, thick scales which are loose at the ends and give a shreddy appearance to the bole.

Habitat—Dry gravelly and stony soils on slopes, ridges and limestone outcrops, rarely on moist sites. A tolerant species occurring in admixture with Beech, Hard Maple, Yellow Birch, White Ash, Elm, etc., seeding abundantly and forming the bulk of the under-growth in many places.

Range—Cape Breton Island westward through Ontario to Manitoba, in the United States from Maine to North Dakota, south to Florida and eastern Texas.

Uses—Wood very heavy, hard, strong, tough, close-grained, light brown, reddish brown, or nearly white, with thick, pale white sapwood. Not durable in contact with the soil. Used for tool handles, mallets, levers, fence posts and for fuel.

*A variety of this species, *Ostrya virginiana* var. *glandulosa* Sarg., with glandular hairs on the branchlets, petioles, and peduncles, is recognized by some authors.



Blue Beech, Hornbeam, Water Beech

Carpinus caroliniana Walt.

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. Pistillate flowers with bract, proximal view $\times 4$
3. A bract from pistillate ament, distal view $\times 4$
4. A bract from staminate ament with stamens, distal view $\times 5$
5. A staminate flower with bract, proximal view $\times 5$
6. A twig showing mature leaves and fruit $\times \frac{1}{2}$
7. Nutlet with trilobed subtending involucre $\times 1\frac{1}{2}$
8. Involucre and nutlet, proximal view $\times 5$
9. Winter twig $\times \frac{1}{2}$

BETULACEAE
***Carpinus caroliniana* Walt.**

Blue Beech, Hornbeam, Water Beech

Habit—A shrub or low bushy tree 25—30 feet in height with a short, smooth-barked, fluted trunk 6—12 inches in diameter, under optimum conditions sometimes 40 feet in height with a trunk 18—24 inches in diameter. Crown round-topped and wide-spreading, consisting of long, wiry, ascending branches which are often pendulous at the tips, and short, thin laterals, the two forming horizontal sprays.

Leaves—Alternate, borne on slender, terete, hairy petioles about $\frac{1}{3}$ of an inch long, ovate-oblong, 2—4 inches long, 1— $1\frac{3}{4}$ inches wide, acuminate at the apex, rounded or cuneate and often inequilateral at the base, finely doubly serrate, at maturity thin, firm, smooth and deep green above, pale green and glabrous or puberulous below with tufts of pale hairs in the axils of the veins.

Flowers—Appearing in April and early May with the leaves. monoecious, borne in aments. Staminate aments arising from lateral buds similar to leaf-buds but larger, at anthesis reddish green, pendent, about $1\frac{1}{2}$ inches long. Pistillate aments appearing with the leaves, terminal on the growth of the season, lax, green, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. The staminate flowers consist of 6—40 yellow half-anthers which are raised on short, bifurcated filaments inserted on a pilose torus, the group subtended by a short-stalked, broadly ovate, concave scale. The pistillate flowers are borne in pairs at the base of an ovate, acute, deciduous bract and consist of an ovary invested by a bracteole and 2 secondary bractlets, a short style, and 2 elongated, filiform, scarlet stigmas.

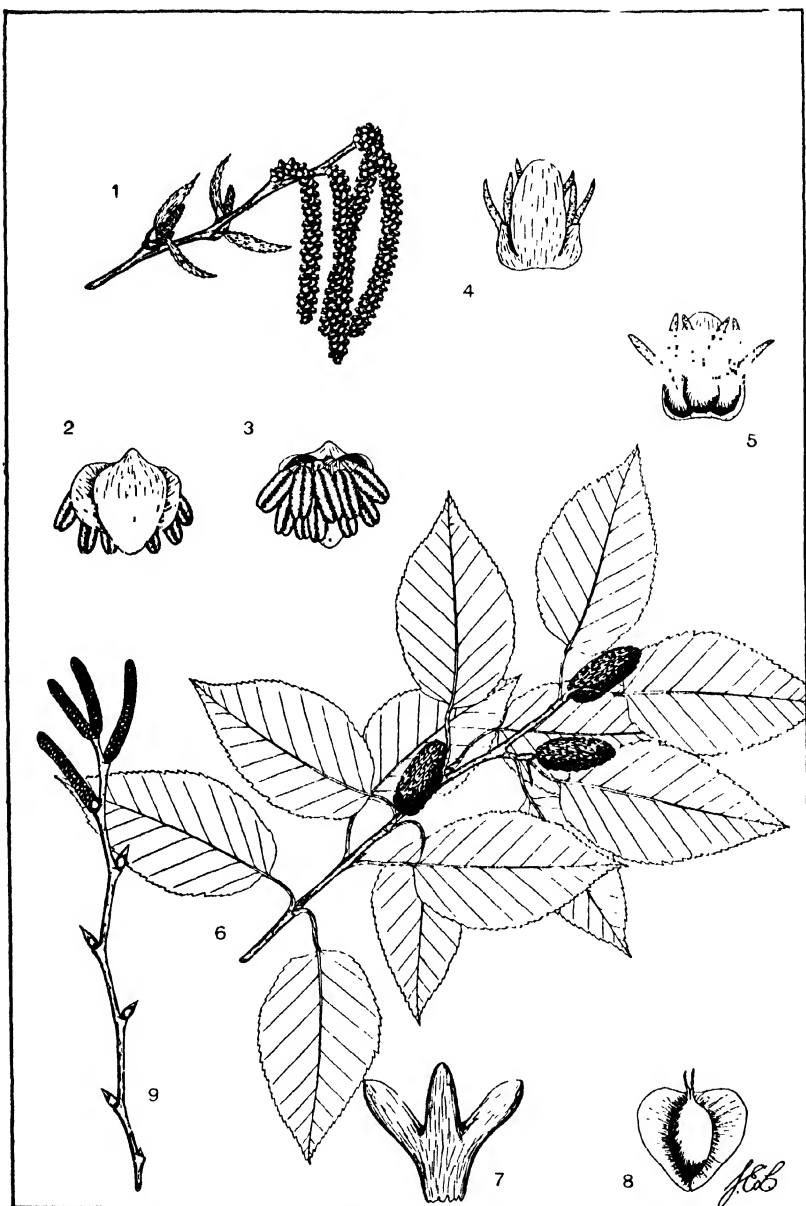
Fruit—A long-pedunculate, pendulous cluster of 3-lobed, foliaceous, green involucre, $1\frac{1}{2}$ —4 inches long, 1—2 inches wide, each involucre usually serrate on one margin and bearing in its axil a broadly ovoid, acute, compressed, corrugated, light brown nutlet. The involucre arise from the fusion of a bracteole and 2 secondary bractlets, and are borne vis-a-vis in pairs.

Winter characters—Twigs very slender, tough, pale-lenticellate, smooth, lustrous, dark reddish brown and often zigzag, at length dull reddish gray. Terminal bud absent. Lateral buds ovate, acute, slightly puberulous, somewhat divergent, light chestnut-brown, about $\frac{1}{8}$ of an inch long. Mature bark bluish gray tinged with brown, thin, forming a smooth layer on the fluted trunk.

Habitat—A moisture-loving 'weed' species usually found in swamps, along the banks of streams, in low wet woods, and on moist slopes.

Range—Nova Scotia through southern and western Quebec to Georgian Bay and central Minnesota, southward to Florida and eastern Texas; also in southern Mexico and Central America.

Uses—Of no commercial significance. Wood very heavy, hard, strong, close-grained, pale yellowish or brownish white, with thick white sapwood. The tree is occasionally used ornamentally on wet, springy sites.



Sweet Birch, Cherry Birch, Black Birch

Betula lenta L.

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. Bract and bracteoles from staminate ament showing stamens, distal view $\times 3$
3. Staminate flowers with subtending bracts and sepals, proximal view $\times 3$
4. Bract and bracteoles from pistillate ament showing styles, distal view $\times 3$
5. Pistillate flowers with subtending bracts, proximal view $\times 3$
6. A twig showing mature leaves and fruiting strobles $\times \frac{1}{2}$
7. Scale from fruiting strobile, distal view $\times 5$
8. Winged nutlet $\times 7$
9. Winter twig $\times \frac{1}{2}$

BETULACEAE

Betula lenta L.

Sweet Birch, Cherry Birch, Black Birch

Habit—A tree under optimum conditions sometimes attaining a height of 75–80 feet with a trunk diameter of 4–5 feet, usually 50–60 feet tall. Crown at first rather narrowly conical, clothed with ascending branches which extend nearly to the ground, at length open, round-topped and rather narrow, with long, slender, horizontal or somewhat pendulous, much-forked branches. Bole in mature trees tapering.

Leaves—Alternate, ovate or oblong-ovate, $2\frac{1}{2}$ –6 inches long, $1\frac{1}{2}$ –3 inches wide, acute or acuminate at the apex, slightly cordate or rounded and often unequal at the base, sharply doubly serrate, with 9–12 pairs of veins, at maturity membranaceous, smooth, dark dull green above, pale yellow-green and smooth below aside from the tufts of white hairs in the axils of the veins, borne on stout, hairy petioles $\frac{3}{4}$ –1 inch long.

Flowers—Appearing in April or early May before the leaves, monocious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 3–4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, cylindrical, sessile, $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, obovate bract and 2 bracteoles. The pistillate flower consists of a small, green, ovoid ovary surmounted by 2 spreading, filiform, pink styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

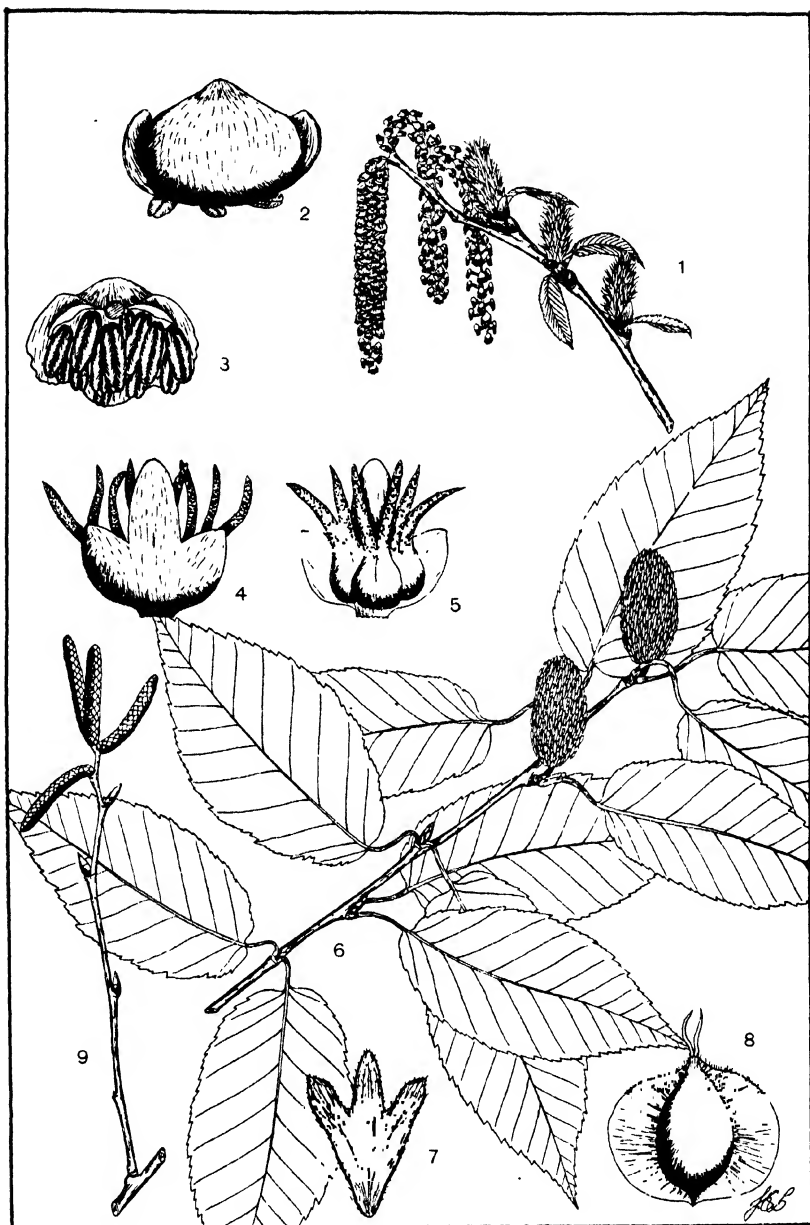
Fruit—An erect, sessile, pale brown, ovoid-oblong, obtuse, woody strobile, 1– $1\frac{1}{2}$ inches long and about $\frac{1}{2}$ inch thick, consisting of glabrous, imbricated, 3-lobed bracts, each subtending 3 winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets obovoid, compressed, about $\frac{1}{8}$ of an inch long, surmounted at the apex by the 2 persistent styles, with lateral marginal wings as broad as the nutlet.

Winter characters—Twigs slender, lenticellate, smooth, lustrous, light reddish brown, at length dull dark brown tinged with red, with wintergreen taste when chewed. Short, spur-like, lateral fruiting branches present. Staminate aments grouped at the tips of vigorous branchlets, oblong-cylindric, reddish brown, lustrous, about $\frac{3}{4}$ of an inch long. Buds ovate, acute, lustrous, divergent, light chestnut-brown, about $\frac{1}{4}$ of an inch long. Bark on young trunks smooth, lustrous, dark reddish brown, with conspicuous horizontal lenticels. Mature bark dull brownish black, furrowed and broken into large, irregular plates, resembling the bark of Black Cherry, hence the common name, Cherry Birch.

Habitat—Prefers deep rich soils but often found in upland situations on moist or dry, gravelly or rocky sites. Never in pure stands or a dominant tree. Commonly associated with Maples, Basswood, Beech, Oaks, Tulip Poplar, etc.

Range—Southern Maine through southern Ontario to Lower Michigan, south to Delaware and Kentucky, and in the mountains to Georgia and Alabama.

Uses—Wood heavy, hard, strong, close-grained, dark reddish brown with thin, pale sapwood. Capable of high finish and used in the manufacture of furniture, frequently to imitate mahogany, likewise for woodenware, fuel, etc. Oil of wintergreen is distilled from the twigs and inner bark, and birch beer can be made by fermenting the sap.



Yellow Birch, Gray Birch

Betula lutea Michx.

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. Bract and bracteoles from staminate ament, distal view $\times 7\frac{1}{2}$
3. Staminate flowers with subtending bracts and sepals, proximal view $\times 7\frac{1}{2}$
4. Bract and bracteoles showing styles, distal view $\times 7\frac{1}{2}$
5. Pistillate flowers with subtending bracts, proximal view $\times 7\frac{1}{2}$
6. A twig showing mature leaves and fruiting strobiles $\times \frac{1}{2}$
7. Scale from fruiting strobile, distal view $\times 5$
8. Winged nutlet $\times 7$
9. Winter twig with staminate aments $\times \frac{1}{2}$

BETULACEAE
***Betula lutea* Michx.**

Yellow Birch, Gray Birch

Habit—A tree at maturity usually 60—75 feet in height with a trunk diameter of 2—3 feet, sometimes 100 feet tall and 3—4 feet through. In the open the crown is broadly ovoid, consisting of long, wide-spreading, somewhat pendulous branches borne aloft on a short bole which is continuous into the crown or breaks up a short distance above the ground into several large, ascending limbs. Under forest conditions the bole is usually clean for some distance.

Leaves—Alternate, ovate to oblong-ovate or elliptical, 3—4½ inches long, 1½—2 inches wide, acute to acuminate at the apex, rounded, broadly wedge-shaped or slightly heart-shaped and often unequal at the base, sharply doubly serrate, with 9—11 pairs of veins, at maturity smooth, dull and dark green above, pale yellowish green and hairy at least on the veins below, borne on slender, pale yellow, hairy, terete petioles ¾—1 inch long.

Flowers—Appearing in late March or April before the leaves, monocious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 3—3½ inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, oblong-ovoid, nearly sessile, about ¾ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, broadly oval bract and 2 bracteoles. The pistillate flower consists of a small, green, ovoid ovary surmounted by 2 spreading, filiform styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

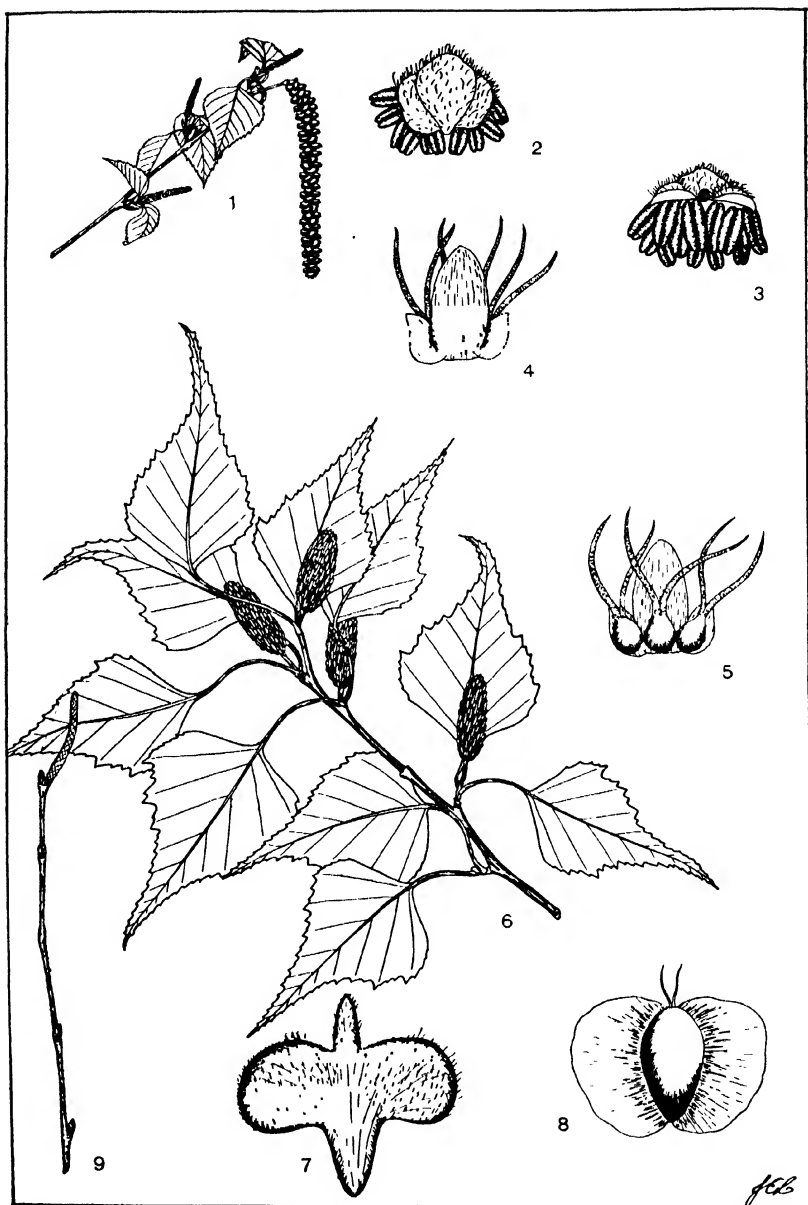
Fruit—An erect, sessile or nearly sessile, pale brown, ovoid-oblong, woody strobile, 1—1½ inches long and about ¾ of an inch wide, consisting of imbricated, 3-lobed bracts which are puberulous on the back and subtend 3 winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets ellipsoidal to obovoid compressed, chestnut-brown, about ⅓ of an inch long, crowned by the 2 persistent styles, with lateral marginal wings narrower than the nutlet. Seed is produced annually in great quantities.

Winter characters—Twigs slender, lenticellate, smooth, light yellowish brown, becoming dark brown and lustrous and finally dull silvery-gray, with faint wintergreen odor when chewed. Short, spur-like, lateral fruiting branches present. Buds narrowly ovate, acute, lustrous, somewhat divergent, chestnut-brown, about ¾ of an inch long, covered by 3—8 scales downy on the margins. Staminate aments grouped at the tips of vigorous twigs, oblong-cylindric, light chestnut-brown and lustrous, ¾—1 inch long. Bark on young trunks or limbs lustrous, close and firm, bright silvery-gray, separating at the surface into thin, revolute, clinging scales. Mature bark reddish brown to nearly black, broken into large, thick, irregular plates.

Habitat—In the North, on rich moist uplands in company with Beech, Sugar Maple, Ash, Hornbeam, Hemlock, Red Spruce, White Pine, and Balsam; associated with the swamp hardwoods in the South. With Beech and Hard Maple, forming the climax hardwood forest of the Adirondacks.

Range—Newfoundland and the northern shores of the Gulf of St. Lawrence westward through southern Ontario and northern Minnesota, south to central Iowa, southern Wisconsin, extreme northern Indiana and central Ohio, and in the mountains to Georgia and Alabama.

Uses—An important timber tree. Wood heavy, hard, strong, close-grained, light reddish brown with thin, nearly white sapwood. Used for furniture, flooring, interior finish, agricultural implements, turnery, and for fuel. The outer scaly bark burns readily, even when wet.



Gray Birch, Old Field Birch, White Birch

Betula populifolia Marsh. [*Betula alba* var. *populifolia* (Marsh.) Spach]

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. Bract and bracteoles from staminate ament showing stamens, distal view $\times 5$
3. Staminate flowers with subtending bracts and sepals, proximal view $\times 5$
4. Bract and bracteoles from pistillate ament showing styles, distal view $\times 15$
5. Pistillate flowers with subtending bracts, proximal view $\times 15$
6. A twig showing mature leaves and fruiting strobiles $\times \frac{1}{2}$
7. Scale from fruiting strobile, distal view $\times 5$
8. Winged nutlet $\times 10$
9. Winter twig $\times \frac{1}{2}$

BETULACEAE

Betula populifolia Marsh. [*Betula alba* var. *populifolia* (Marsh.) Spach.]

Gray Birch, Old Field Birch, White Birch

Habit—A small tree 20—30 feet high with a trunk diameter of 6—12 inches, occasionally 50 feet tall with a diameter of 18 inches. The boles usually arise in groups of 2—6 from a common root-crown. Crown open, rather irregular, narrowly pyramidal, often extending to the ground, consisting of slender, ascending or horizontal branches and drooping branchlets. Bole continuous to the top of the crown.

Leaves—Alternate, triangular to narrowly rhombic-ovate, $2\frac{1}{2}$ —3 inches long, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches wide, long-attenuate at the apex, broadly cuneate or truncate at the base, coarsely doubly serrate, glutinous when young, at maturity thin but firm in texture, dark green, lustrous and somewhat glandular above, pale green and glabrous or hairy on the veins below, borne on black-glandular, terete petioles $\frac{3}{4}$ —1 inch long.

Flowers—Appearing in late March or April with the leaves, monoecious, borne in aments. Staminate aments preformed the previous season, usually solitary, subterminal, narrowly cylindrical, at anthesis brownish yellow, $2\frac{1}{2}$ —4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary or rarely in pairs on short, 2-leaved lateral branches, pale green, linear-cylindrical, pedunculate, $\frac{1}{2}$ —1 inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, obovate bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary crowned by 2 spreading, filiform, pale red styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

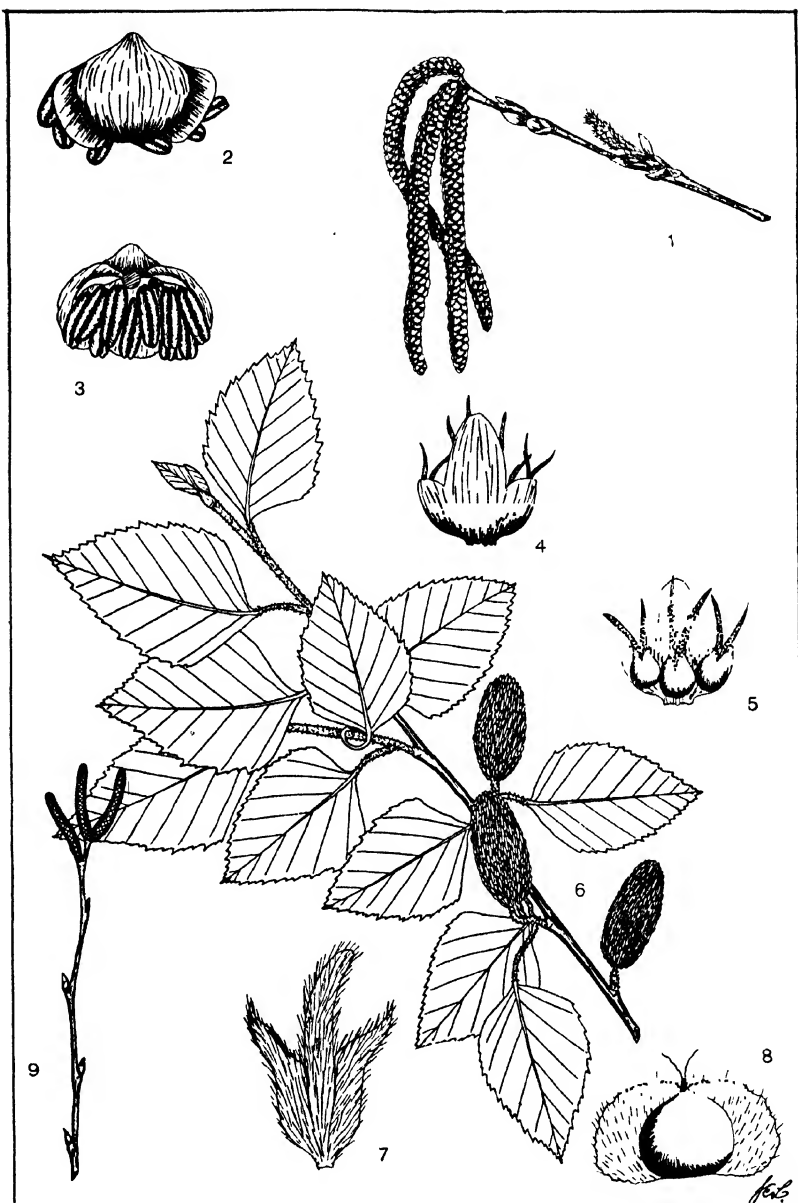
Fruit—A pendent or spreading, slender-pedunculate, pale brown, cylindrical, obtuse, woody strobile, about $\frac{3}{4}$ of an inch long and $\frac{1}{2}$ of an inch wide, consisting of puberulous, imbricated, 3-lobed bracts, each subtending 3 winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets ellipsoidal to obovoid, compressed, chestnut-brown, $\frac{1}{8}$ — $\frac{1}{2}$ of an inch long, crowned by the 2 persistent styles, with lateral marginal wings broader than the nut.

Winter characters—Twigs slender, lenticellate, lustrous, roughened by warty glands, reddish brown or nearly white near the trunk. Buds ovate, acute, smooth, somewhat resinous and divergent, covered by 3—4 scales downy at the margins. Staminate aments usually solitary, subterminal, linear-cylindrical, $1\frac{1}{4}$ — $1\frac{1}{2}$ inches long. Mature bark thin, close, dull grayish white with bright orange inner bark, nearly black and fissured at the base of the tree.

Habitat—A short-lived 'weed' tree producing abundant seed and establishing itself rapidly in abandoned fields, and on burns and waste lands. Thrives on poor sandy soils and impoverished land. Commonly associated with White Pine in New England. An intolerant species.

Range—Newfoundland, Nova Scotia and New Brunswick, southward (mostly near the coast) to Delaware, westward along the north bank of the St. Lawrence River and northern New England into New York and northern Pennsylvania.

Uses—Not an important timber species. Occasionally grown ornamentally. Wood light, soft, weak, close-grained, pale brown with thick, nearly white sapwood. Used largely for fuel, also for spools, shoe pegs, woodenware, etc.



River Birch, Red Birch, Black Birch

Betula nigra L.

1. A twig showing pistillate and staminate aments x 1
2. Bract and bracteoles from staminate ament showing stamens, distal view x 8
3. Staminate flowers with subtending bracts and sepals, proximal view x 8
4. Bract and bracteoles from pistillate ament showing styles, distal view x 6
5. Pistillate flowers with subtending bracts, proximal view x 6
6. A twig showing mature leaves and fruiting strobiles x 1/2
7. Scale from fruiting strobile, distal view x 2
8. Winged nutlet x 4
9. Winter twig x 1/2

BETULACEAE

Betula nigra L.

River Birch, Red Birch, Black Birch

Habit—A tree 30–60 feet in height with a short trunk usually dividing near the base into several large, obliquely ascending limbs which form in age a round-topped, open, irregular crown. Under optimum conditions sometimes 80–100 feet in height with a bole 4–5 feet through, at other times a bushy tree branching from the ground.

Leaves—Alternate, rhombic-ovate, $1\frac{1}{2}$ –3 inches long, 1–2 inches wide, acute at the apex, broadly cuneate at the base, doubly serrate to incised, with 7–9 pairs of veins, at maturity thin but firm in texture, dark green, smooth, and lustrous above, pale yellowish green and glabrous or slightly pubescent below, borne on slender, pubescent petioles about $\frac{1}{2}$ of an inch long. Stipules pale green, ovate, fugacious.

Flowers—Appearing in March and April before the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 2–3 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, bright green, cylindrical, pedunculate, about $\frac{1}{3}$ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments accompanied by a calyx of 1 sepal and covered distally by a peltate, broadly oval bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary surmounted by 2 spreading, filiform styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 bracteoles.

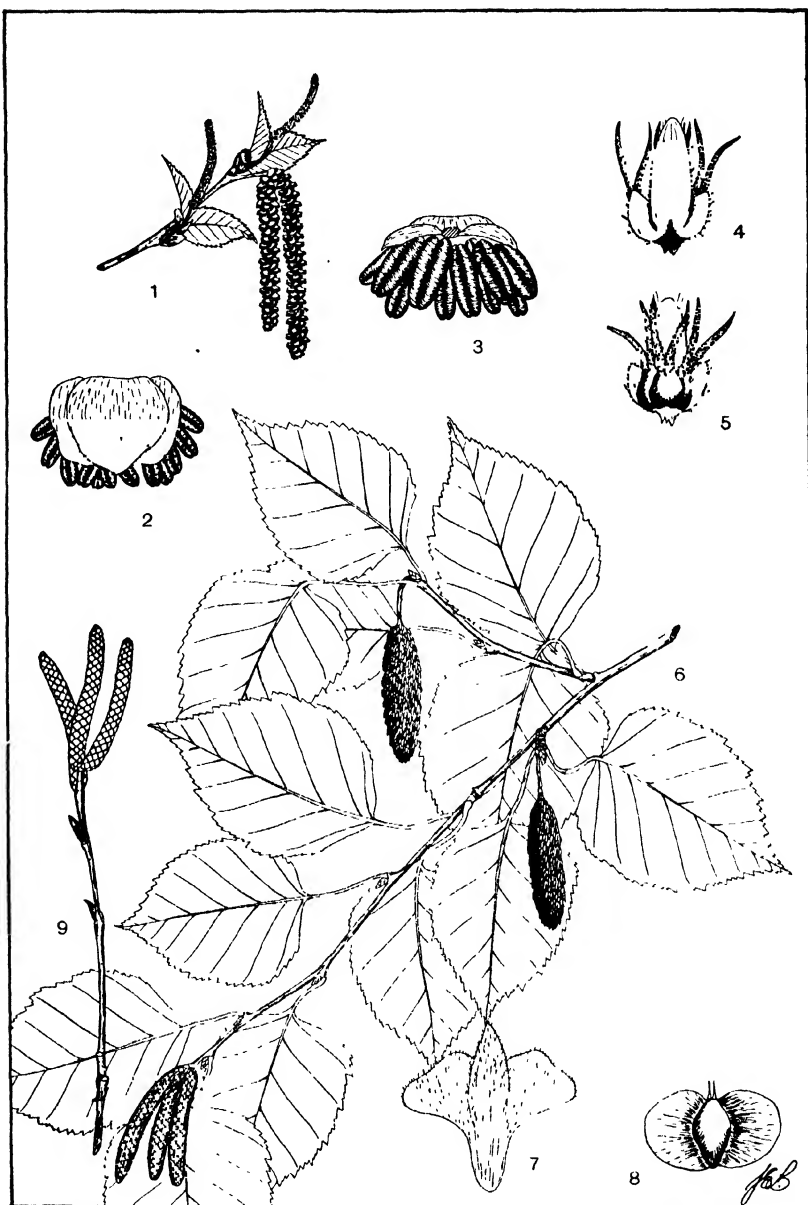
Fruit—Maturing in May and June. An erect, pedunculate, pubescent, pale brown, oblong-cylindrical, woody strobile, 1– $1\frac{1}{2}$ inches long and about $\frac{1}{2}$ inch wide, consisting of imbricated, 3-lobed bracts which are pubescent on the back and subtend 3 winged nutlets, both deciduous in mid-summer from the slender rachis. Nutlets broadly ovoid compressed, chestnut-brown, about $\frac{1}{8}$ of an inch long, crowned by the 2 persistent styles, with lateral, marginal, pubescent wings narrower than the nutlet.

Winter characters—Twigs slender, lenticellate, hairy, reddish brown and lustrous, at length darker, the bark exfoliating in thin, papery scales. Buds ovate, acute, smooth or somewhat hairy, divergent, covered by 3–7 chestnut-brown scales. Staminate aments clustered, subterminal, cylindrical, $\frac{3}{4}$ –1 inch long. Bark on limbs and upper part of bole light reddish brown to cinnamon red, exfoliating in papery, clinging scales, giving the trunk a ragged appearance. Mature bark at the base of the trunk dark reddish brown and fissured.

Habitat—A moisture-loving species typically found along the banks of streams, ponds, and lakes, and on sites frequently inundated by flood waters, more rarely on drier sites.

Range—Southern New Hampshire westward through northern Pennsylvania, central Ohio, c. Indiana and c. Illinois to northeastern Minnesota, east of the Appalachians to western Florida, in the West southward through eastern Iowa and c. Oklahoma to eastern Texas.

Uses—Wood light, medium hard, strong, close-grained, light brown with wide, pale sapwood, often with dark streaks which are the occluded mines of cambial miners that have been included in the wood. Used in the manufacture of cheap furniture and woodenware. The tree is attractive ornamentally and is grown in parks, cemeteries and private estates.



Paper Birch, Canoe Birch, White Birch

Betula papyrifera Marsh. [*Betula alba* var. *papyrifera* (Marsh.) Spach.]

1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
2. Bract and bracteoles from staminate ament showing stamens, distal view $\times 7$
3. Staminate flowers with subtending bracts and sepals, proximal view $\times 7$
4. Bract and bracteoles from pistillate ament showing styles, distal view $\times 15$
5. Pistillate flowers with subtending bracts, proximal view $\times 15$
6. A twig showing mature leaves and fruiting strobiles $\times \frac{1}{2}$
7. Scale from fruiting strobile, distal view $\times 4$
8. Winged nutlet $\times 4$
9. Winter twig $\times \frac{1}{2}$

BETULACEAE

Betula papyrifera Marsh. [*Betula alba* var. *papyrifera* (Marsh.) Spach.]*

Paper Birch, Canoe Birch, White Birch

Habit—A tree at maturity usually 50—70 feet in height with a trunk diameter of 1—2 feet, under optimum conditions sometimes 120 feet tall. Crown in young trees extending nearly to the ground, narrowly pyramidal, consisting of short, slender, spreading branches. In mature or crowded trees, the bole is clean below and supports a rather narrow, round-topped, open head with pendulous branches. Sprouts readily from the stump.

Leaves—Alternate, ovate to oval, acuminate at the apex, rounded or cuneate at the base, coarsely doubly serrate, 2—3 inches long, $1\frac{1}{2}$ —2 inches wide, at maturity thick and firm in texture, dull dark green and usually glandular above, pale yellowish green, glabrous or somewhat hairy (especially on the veins) and marked with minute black glands beneath, borne on stout, yellow, pubescent, black-glandular petioles. Stipules fugacious.

Flowers—Appearing in April and May with the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, usually in groups of 2—3, subterminal, cylindrical, at anthesis brownish yellow, $3\frac{1}{2}$ —4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, linear-cylindrical, pedunculate, $1-1\frac{1}{4}$ inches long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, broadly obovate bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary crowned by 2 spreading, filiform, bright red styles, the clusters of 3 subtended by an oblong, obtuse bract and 2 bracteoles.

Fruit—A pedunculate, drooping, pale brown, cylindrical, obtuse, woody strobile, about $1\frac{1}{2}$ inches long and $\frac{1}{4}$ of an inch thick, consisting of puberulous or glabrous, imbricated, 3-lobed bracts, each subtending 3 winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets ellipsoidal, compressed, chestnut-brown, about $\frac{1}{8}$ of an inch long, with marginal wings broader than the nut.

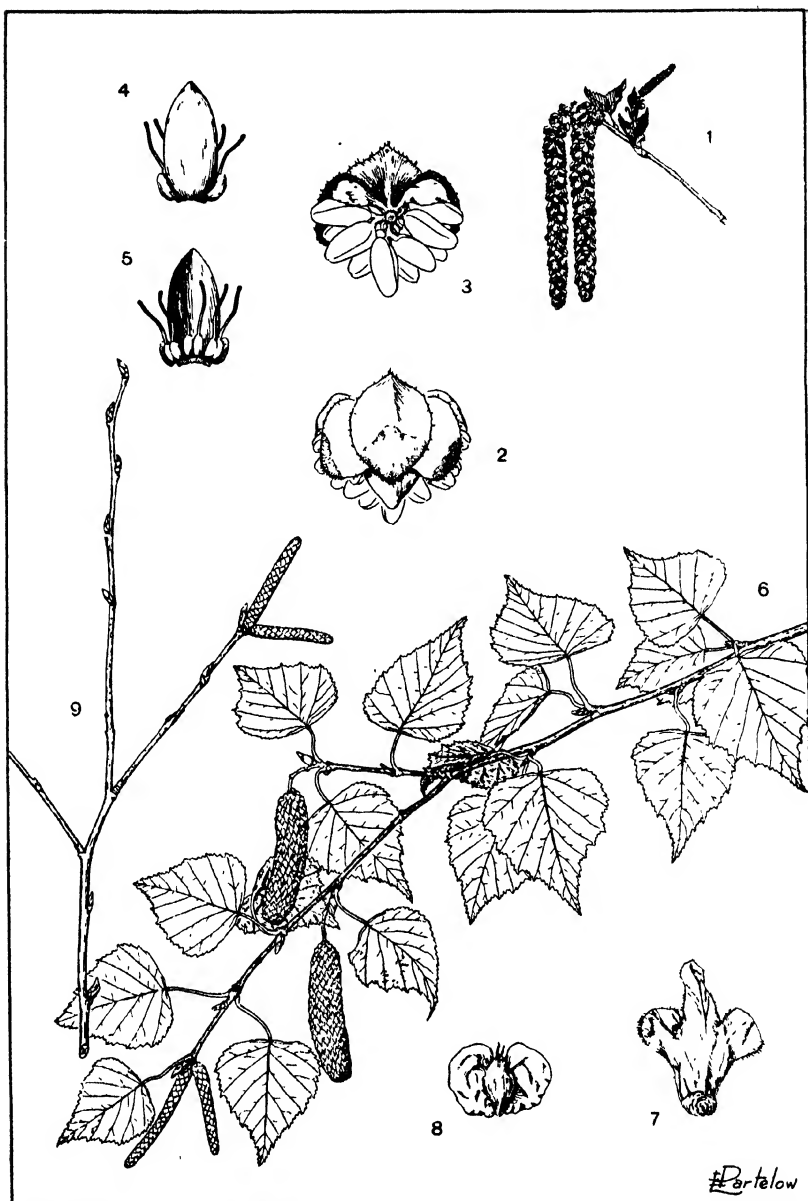
Winter characters—Twigs rather stout, lenticellate, smooth, dull reddish brown, at length orange-brown and lustrous, finally white from the exfoliation of the outer bark. Buds ovate, acute, smooth, divergent, chestnut-brown, covered by 3—5 scales downy at the margins. Staminate strobiles in groups of 2—3, subterminal, cylindrical, $\frac{3}{4}$ — $1\frac{1}{2}$ inches long. Bark on the trunk and older branches chalky to creamy-white, peeling off in thin papery layers, marked by elongated, horizontal lenticels. Mature bark at the base of mature trunks brownish black, sharply and irregularly furrowed.

Habitat—Thrives on moist sites about lakes, streams, swamps, wooded mountain slopes and hillsides, often forming pure stands in forests of Spruce, Balsam, and some of the northern hardwoods.

Range—A transcontinental species ranging from Newfoundland to Alaska, south through New England to northern Pennsylvania, westward through extreme northern Indiana and e. n. Illinois (not in Ohio), northern Iowa and northern Nebraska to northern Wyoming, thence northward on the west slopes of the Rockies.

Uses—Wood light, strong, hard, close-grained, light reddish brown with thick, nearly white sapwood. Largely used in the manufacture of spools, woodenware, shoe-last, wood-pulp and fuel. The papery bark is made into canoes and souvenirs, and sometimes the wood is stained in the living tree by injecting dyes into the wide sapwood at the base. The tree is grown ornamentally in the northern states, replacing in many places the European White Birch destroyed by the Bronze Birch Borer to which it is less susceptible.

*A variety of Paper Birch, *Betula papyrifera* var. *cordifolia* (Roth) Fernald, is found at higher elevations on cool mountain slopes in New England and New York.



European White Birch, Silver Birch

- Betula pendula** Roth. [*Betula verrucosa* Ehrh.; *Betula alba* L. in part]
1. A twig showing pistillate and staminate aments $\times \frac{1}{2}$
 2. Bract and bracteoles from staminate ament showing stamens, distal view $\times 7$
 3. Staminate flowers with subtending bracts and sepals, proximal view $\times 7$
 4. Bract and bracteoles from pistillate ament showing styles, distal view $\times 15$
 5. Pistillate flowers with subtending bracts, proximal view $\times 15$
 6. A twig showing mature leaves and fruiting strobiles $\times \frac{1}{2}$
 7. Scale from fruiting strobile, distal view $\times 4$
 8. Winged nutlet $\times 4$
 9. Winter twig $\times \frac{1}{2}$

BETULACEAE

Betula pendula Roth. (*Betula verrucosa* Ehrh.; *Betula alba* L. in part)

European White Birch, Silver Birch

Habit—A short-lived tree, under optimum conditions attaining a maximum height of 60–65 feet but generally 40–50 feet at maturity, with a slender trunk seldom over 1 foot in diameter which extends through to the tip of the tree and supports a more or less ovoid crown of slender, weak, ascending branches terminating in drooping branchlets.

Leaves—Alternate, ovate to deltoid, acuminate at the apex, subcuneate, truncate, or subcordate at the base, doubly serrate, glabrous from the first, glutinous when young, 1–2½ inches long, 1–2 inches wide, at maturity thin, firm in texture, dark green and somewhat lustrous above, pale yellowish green and more or less lustrous beneath, borne on slender petioles ½–1 inch long.

Flowers—Appearing in April and May with the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, projecting forward in groups of 1–3 from the ends of the twigs (one terminal and the others lateral), light green, sessile, at anthesis brownish yellow, pendent, 2–2½ inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 1–3-leaved lateral branches, ascending, pale green, linear-cylindrical, pedunculate, ½–1 inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of three covered distally by a peltate, broadly obovate bract and 2 bracteoles. Pistillate flowers consisting of a small, green, 2-lobed ovary crowned by 2 spreading, filiform bright red styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 bracteoles.

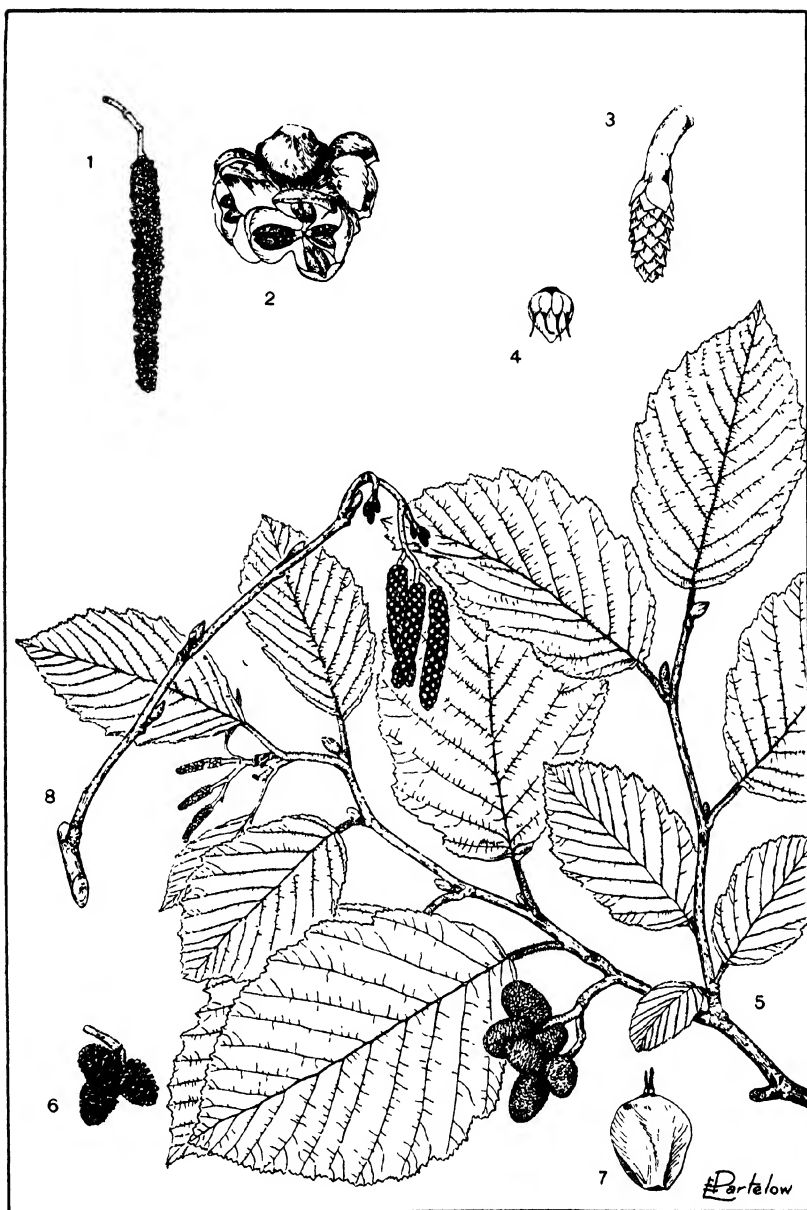
Fruit—A pedunculate, drooping, pale brown, cylindrical, obtuse, woody strobile, 1–1½ inches long and about ⅓ of an inch thick, consisting of puberulous or glabrous, imbricated, 3-lobed bracts, each subtending 3 winged nutlets, both deciduous at length (the strobiles sometimes persist on the tree for some time) from the slender rachis. Nutlets compressed, ellipsoid to ovoid, chestnut-brown, about 3/32ths of an inch long, with marginal wings broader than the nut.

Winter characters—Twigs slender, glabrous, speckled with lenticels and the remains of resin-glands, at first light orange-brown and lustrous, becoming dull reddish brown and eventually white from the exfoliation of the outer bark. Spur-shoots frequent. Buds narrowly ovoid, flattened, acute, smooth, divergent, chestnut-brown, covered by 2–3 exposed scales; terminal bud lacking except on spur-shoots. Staminate strobiles in groups of 1–3 on the ends of the twigs (one terminal and the others lateral), cylindrical, ¾–1¼ inches long. Bark on the trunk and older branches chalky white, peeling off in thin papery layers, marked by prominent, elongated, horizontal lenticels, becoming furrowed and almost black near the ground.

Habitat—Thrives best on uplands. Not exacting in its soil requirements and apparently growing equally well on sandy or gravelly soils on dry or moist sites. Intolerant of shade.

Range—Grown as an ornamental in eastern United States and occasionally found as an 'escape' in the Northeastern States. Confined originally to Europe and Asia Minor but long cultivated as a park and lawn tree and now widely distributed.

Uses—Utilized only as an ornamental in eastern United States where it has not proven too satisfactory because of its proneness to storm injury and the ravages of the Bronze Birch Borer (*Agrilus anxius* Gory), a beetle which attacks the crown at the apex and works downward. A number of varieties have been evolved through cultivation, several of which are propagated in eastern United States. Wood light, strong, medium hard, close grained, light reddish brown with thick, nearly white sapwood. Not distinguished in the European trade from that of *Betula pubescens* Ehrh., an allied species, and used abroad for turnery, shoe-last, fuel, etc.



Speckled Alder

Alnus incana (L.) Moench.

1. A pendent, staminate ament $\times \frac{1}{2}$
2. A 3-flowered cyme of 4-merous staminate flowers from the staminate ament, with bract and bractlets $\times 5$
3. A pistillate ament $\times 2$
4. Scale from pistillate ament, proximal view, showing two pistillate flowers $\times 5$
5. Branch showing mature foliage, mature unopened strobiles, and immature staminate and pistillate aments for the next season $\times \frac{1}{2}$
6. Mature strobiles after seed dispersal $\times \frac{1}{4}$
7. Winged nutlet $\times 5$
8. Winter twig showing preformed staminate and pistillate aments $\times \frac{1}{2}$

BETULACEAE

Alnus incana (L.) Moench.

Speckled Alder*

Habit—Occasionally a small tree up to 20 feet in height with a trunk generally under 5 inches in diameter, more often a large shrub breaking up near the ground into a rounded clump of ascending stems and slender branches.

Leaves—Deciduous, alternate, simple, broadly elliptical to ovate, $1\frac{1}{4}$ ths—4 inches long, 1 to 3 inches broad, acute, usually rounded at the base, sharply and doubly serrate and usually shallowly lobed, dull dark green and with impressed veins above, glaucous or grayish green and pubescent or nearly glabrous below, borne on short, rather stout petioles $\frac{1}{4}$ th— $\frac{1}{2}$ ths of an inch long.

Flowers—Appearing in March and April before the leaves, monoecious and proximate on the same twig, in pedunculate aments preformed the preceding season. Staminate aments in paniced clusters of 2—5 in the axils of the last leaves of the preceding season or of leafy bracts, cylindrical, pendulous, reddish brown and about 2 inches long at anthesis. Staminate flowers in 3-flowered cymes in the axils of peltate, short-stalked scales, the cluster subtended by 4 bractlets adnate to the base of the scale. Calyx 4-parted, with 4 short-stalked stamens borne opposite its divisions. Pistillate aments in clusters of 3—8, borne below the staminate aments on a branch developed from the axil of one of the upper leaves on the growth of the preceding season, ovoid-oblong, upright, purplish brown, about $\frac{1}{4}$ ths of an inch long, sessile or short-stalked. Pistillate flowers in pairs in the axils of the fleshy scales, each flower subtended by two bractlets adnate to the scale, consisting of a naked, 2-celled ovary surmounted by 2 scarlet styles which project slightly beyond the scale at anthesis.

Fruit—A sessile, or short-stalked, blackish brown ovoid-cylindrical, woody, cone-like catkin (strobile) $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long which persists until the following spring. Seed-like nutlet minute, chestnut-brown, obovate, compressed, surmounted at the apex by the remnants of the two styles, narrowly winged. The fruits are often distorted by strap-like projections which are caused by a fungus.

Winter characters—Twigs rather slender, weak, more or less zigzag, grayish brown and becoming hoary white toward the apex (especially the apices of the fruiting twigs), finely pubescent, marked with whitish, scattered, conspicuous lenticels. Buds stalked, rounded, reddish and more or less whitened with fine pubescence, about $\frac{1}{4}$ of an inch long; terminal buds scarcely longer than the laterals; bud scales stipular (3 visible), subequal, closely stuck together. Aments preformed; staminate aments in pendent clusters of 2—5, reddish brown, $\frac{3}{4}$ th—1 inch long; pistillate aments in clusters of 3—8 below the staminate clusters, purplish brown, about $\frac{1}{4}$ th of an inch long. Pith triangular, dark green.

Habitat—A moisture-loving species common along sluggish streams and on swampy bottomlands where it often forms extensive, dense thickets to the near exclusion of other shrubby plants. Seldom occurs on slopes. Avoids limestone soils.

Range—Newfoundland to Saskatchewan, south to Pennsylvania, northern Iowa, and Nebraska. The common alder of the Northeastern States.

Uses—Of some value as a soil binder along the banks of streams because of the numerous fibrous roots. The roots develop nodules containing nitrogen-fixing bacteria, comparable to those found on the roots of leguminaceous plants. Dense alder thickets tend to conserve trout streams and provide cover for game, especially woodcock. At one time the wood was converted into charcoal which was used in the manufacture of gunpowder.

*The Smooth Alder, *Alnus rugosa* (Du Roi) Spreng., also occurs in the range of this text and is often confused with Speckled Alder. It can be separated on the basis of leaf-characters; the leaves are prevalently obovate, acute at the base, sharply and regularly serrate, and smooth and sparingly pubescent beneath.



Beech, American Beech

***Fagus grandifolia* Ehrh. [*Fagus americana* Sweet; *Fagus atropuncea* (Marsh) Sudw.; *Fagus ferruginea* Ait.]**

1. A twig showing pistillate and staminate flowers, and immature leaves x 1
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x $\frac{1}{2}$
5. Trigonous nut x 2
6. Winter twig x $\frac{1}{2}$

FAGACEAE

Fagus grandifolia Ehrh. [*Fagus americana* Sweet; *Fagus atropunicea* (Marsh) Sudw.; *Fagus ferruginea* Ait.]

Beech, American Beech

Habit—A tree under optimum conditions sometimes 120 feet in height, usually 60—80 feet in height with a trunk 2—3 feet in diameter. Crown compact and narrow under forest conditions, borne aloft on a long, straight, columnar bole. In the open the trunk is short and thick, and breaks up a few feet above the ground into numerous spreading limbs and slender, somewhat drooping branches which form a broad, round-topped head. Root suckers very abundant, often forming extensive thickets around the base of old trees. Stump sprouts not vigorous.

Leaves—Alternate, oblong-ovate, $2\frac{1}{2}$ —5 inches long, 1—3 inches wide, acuminate at the apex, cuneate or rounded at the base, sharply serrate with rather distant teeth, silky when unfolding, at maturity thin, coriaceous, smooth and dull green above, pale green and lustrous beneath, with tufts of hairs in the axils of the prominent, rib-like, secondary veins, borne on short, hairy petioles about $\frac{1}{4}$ of an inch long.

Flowers—Appearing in April or May when the leaves are about one-third grown, monoecious. Staminate flowers in many-flowered, drooping, globose heads which are about 1 inch in diameter and are borne on slender, scaly peduncles about 2 inches long arising from the axils of the inner bud-scales or of the lower leaves; calyx narrowly campanulate, pale hairy without, 4—8-lobed, borne on a short peduncle; stamens 8—10, with pale green anthers and slender filaments, the filaments about twice the length of the calyx. Pistillate flowers in clusters of 2 on short, clavate, woolly peduncles from the upper leaf-axils, the cluster surrounded by an involucre of accrescent scales clothed with long white hairs and subtended by several deciduous, pink bracts; calyx hairy, adnate to the ovary, with 4—5 linear lobes; pistil consisting of a trigonous, 3-celled ovary surmounted by 3 slender, reflexed styles stigmatic on the inner surface.

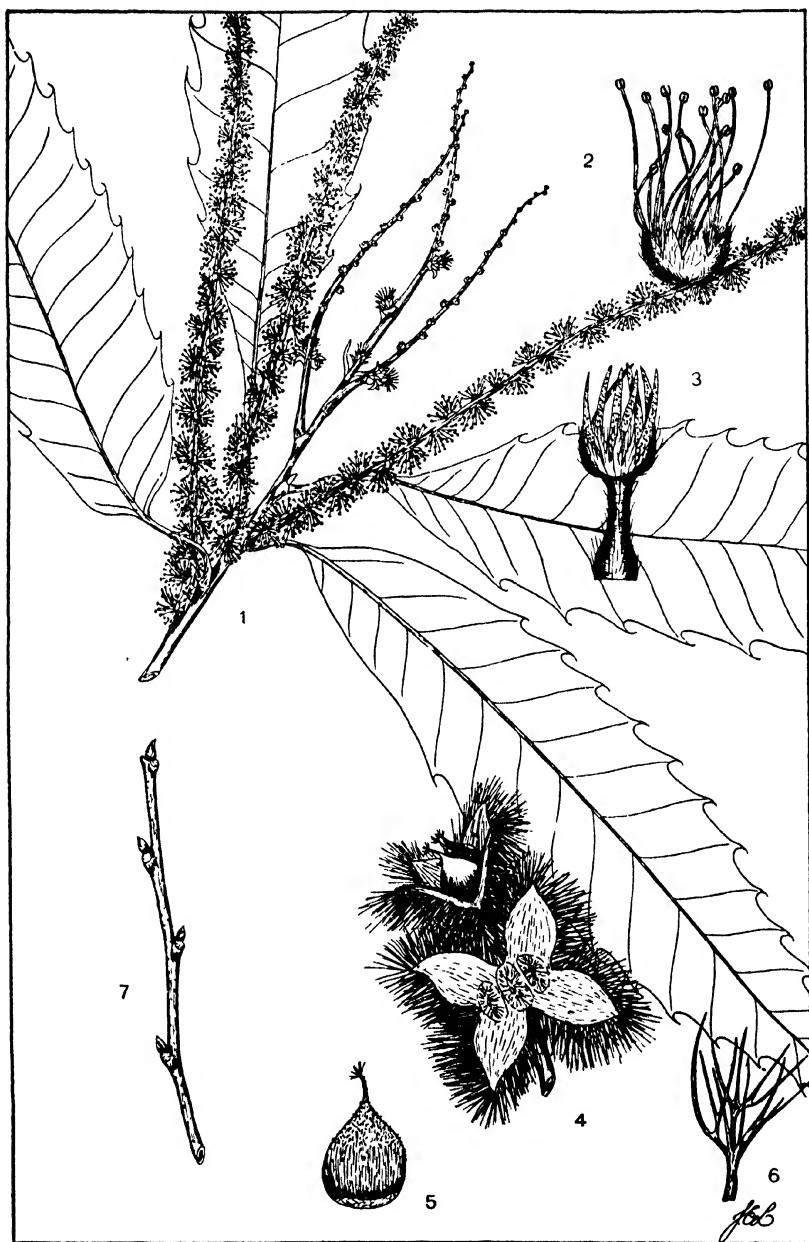
Fruit—A light brown, ovoid, tomentose, thick-walled bur, about $\frac{3}{4}$ of an inch long, covered with crowded, recurved, unbranched prickles, borne on a stout, hairy, club-shaped stalk. The bur opens in the autumn by 4 valves to set free the 2 trigonous, lustrous brown nuts. Kernel sweet, edible.

Winter characters—Twigs slender, zigzag, wiry, orange-lenticellate, smooth, lustrous, bright reddish brown, at length dark brown turning to ashy gray, with tardily deciduous leaves. Buds narrowly conical, sharp-pointed, strongly divergent, $\frac{3}{4}$ —1 inch long, covered by numerous, thin-lustrous, pale chestnut-brown scales with hairy margins. Mature bark thin, close, smooth, dull light gray, often mottled with dark spots.

Habitat—A tolerant species, preferring rich, moist uplands, forming with Hard Maple and Yellow Birch the typical hardwood mixture of the Northeast. In the South associated with Basswood, Tulip Poplar, Cherry, Ash, Sycamore, Pin Oak, etc. Occasionally in almost pure stands.

Range—New Brunswick westward to the northern shores of Lake Huron, northern Michigan, and north central Wisconsin, south to northern Florida and eastern Texas.

Uses—A timber species producing a hard, strong, tough, close-grained wood which is susceptible of high polish but difficult to season and not durable in contact with the soil. Heartwood light or dark red; sapwood nearly white. The wood is used for cheap furniture, tool handles, basketry (as veneer), and largely in rural districts for fuel. The tree is to be recommended ornamentally because of its striking appearance, especially during the winter months. The nuts occasionally appear in the eastern markets.



Chestnut, American Chestnut

Castanea dentata (Marsh.) Borkh. [*Castanea vesca* var. *americana* Michx.; *Castanea americana* (Michx.) Raf.]

1. A twig showing pistillate and staminate flowers, and mature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{8}{10}$
3. A pistillate flower, lateral view $\times \frac{10}{10}$
4. Opened burs showing nuts and nut-scars $\times \frac{1}{2}$
5. Nut $\times 1$
6. Spine from bur $\times 1\frac{1}{2}$
7. Winter twig $\times \frac{1}{2}$

FAGACEAE

Castanea dentata (Marsh.) Borkh. [*Castanea vesca* var. *americana* Michx.; *Castanea americana* (Michx.) Raf.]

Chestnut, American Chestnut

Habit—Formerly an important timber species, usually 70–90 feet tall, under optimum conditions sometimes 120 feet in height with a restricted crown and tall columnar trunk up to 10 feet in diameter. Trees in the open have a short, massive bole which soon breaks up into stout, wide-spreading limbs to form a very broad, ovate, rounded head. Abundant seed is produced from healthy trees. Chestnut sprouts readily from the stump after cutting (coppice growth) and it is not uncommon to find several trees that have arisen from sprouts in this way, grouped about an old stump.

Leaves—Alternate, oblong-lanceolate, 6–8 inches long, $1\frac{1}{2}$ –2 inches wide, acuminate at the apex, cuneate at the base, coarsely serrate, at maturity thin, glabrous, dull, yellow-green above, smooth and paler beneath, borne on stout, puberulent petioles about $\frac{1}{2}$ of an inch long.

Flowers—Appearing in late June or July after the leaves have attained full size, monoecious. Staminate flowers in erect, deciduous aments 6–8 inches long consisting of stout, green, puberulous stems arising from the axils of the leaves of the year or of the inner scales of the terminal bud, and sessile flower clusters; calyx campanulate, pale brown, puberulous, 6-lobed; stamens 10–20, with long, slender, white filaments and pale yellow anthers. Pistillate flowers at the base of the upper androgynous aments in clusters of 3 (2–5), each cluster enclosed in a green, sessile involucre of thick, imbricated, sharp-pointed, slightly hairy scales subtended by several bracts; calyx hairy, adnate to the ovary, with short, 6-lobed limb; pistil consisting of a 6-celled ovary surmounted by 6 white, linear, spreading styles stigmatic at the apex.

Fruit—A sessile, globose, light brown bur, 2–2½ inches in diameter, densely echinulate with branched spines and usually tomentose without, opening the first autumn by 4 valves and exposing the 1–3 nuts and the velvety inner surface. Nuts ovoid, laterally compressed, pubescent at the apex, lustrous below, dark chestnut-brown, marked at the base by a large, pale, oval scar. Kernel sweet, edible.

Winter characters—Twigs rather stout, white-lenticellate, smooth, lustrous, olive or yellowish green, at length dark brown. Terminal bud absent. Lateral buds ovate, acute, divergent, dark chestnut-brown. Mature bark dark brown, thick, divided by shallow fissures into broad, flat ridges scaly on the surface.

Habitat—Thrives on a wide variety of sites and soils but avoids a wet habitat. In the North common on gravelly, well-drained, glacial soils and on sandy loams; farther south an inhabitant of cool mountain slopes where it occurs in mixture with other hardwoods.

Range—Southern Maine through southern Ontario to southern Michigan, in the East along the coast to Virginia, and at higher elevations inland to northwestern Florida and northern Alabama, in the West extending southward through central Indiana to northern Mississippi.

Uses—An important timber tree. Wood light, soft, rather weak, coarse-grained, difficult to season but very durable in contact with the soil. Heartwood grayish brown to brown; sapwood thin and pale. Formerly largely used for railroad ties, telephone and telegraph poles, fence posts, coffins, cheap furniture, interior finish and as a source of tannin extract. The supply has been greatly depleted through the ravages of the chestnut-bark disease, caused by a fungus, *Endothia parasitica* (Murr.) And., which kills the tree. The tree was important silviculturally because of the readiness with which it could be coppiced. The American chestnuts of commerce are produced by this species.



White Oak

Quercus alba var. *latiloba* Sarg.

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times \frac{5}{6}$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1\frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus alba var. *latiloba* Sarg.*

White Oak

Habit—A valuable timber species, usually attaining a height of 60–80 feet with a trunk 2–3 feet in diameter, under optimum conditions sometimes 100 feet tall and 4 feet in diameter. Trees in dense forest stands have long, clean boles with little taper, bearing aloft a narrow crown. In the open the bole is short and stout, and soon breaks up into massive, gnarled, wide-spreading limbs and slender rigid branches to form a broad, open, irregular crown. Coppice-sprouts are produced by this species.

Leaves—Alternate, obovate-oblong, 5–9 inches long, 2–4 inches wide, cuneate at the base, 3–9-lobed, the lobes ascending and blunt and separated by wide, rounded sinuses which are shallow or may extend nearly to the midrib. Upper lobes irregular, often with secondary lobes at the apex. At maturity the leaves are thin, firm, glabrous, dull or lustrous and bright green above, and paler, smooth and sometimes glaucous beneath. Petioles stout, glabrous, $\frac{1}{2}$ –1 inch long.

Flowers—In the North appearing in late May or early June when the leaves are about one-third grown, monoecious. Staminate flowers bracteolate, in interrupted, filiform, pendulous, deciduous aments $2\frac{1}{2}$ –3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, bright yellow, pubescent, acutely lobed; stamens 4–6, with filiform exerted filaments and yellow, notched anthers. Pistillate flowers solitary, pedunculate or nearly sessile, borne in the axils of the leaves of the season, each subtended by broadly ovate, hairy involucre scales; calyx urn-shaped, shallowly lobed, adnate to the ovary; pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short, dilated, spreading, red styles stigmatic on the inner surface.

Fruit—A sessile or slender-pedunculate acorn, ripening the first season. Nut ovoid-oblong, light chestnut-brown and lustrous at maturity, rounded at the apex, about $\frac{3}{4}$ of an inch long, enclosed about one-fourth its length in the cup. Cup cup-shaped, puberulent, somewhat roughened or tubercled at the base. Seed-crops occur at intervals of 4–7 years.

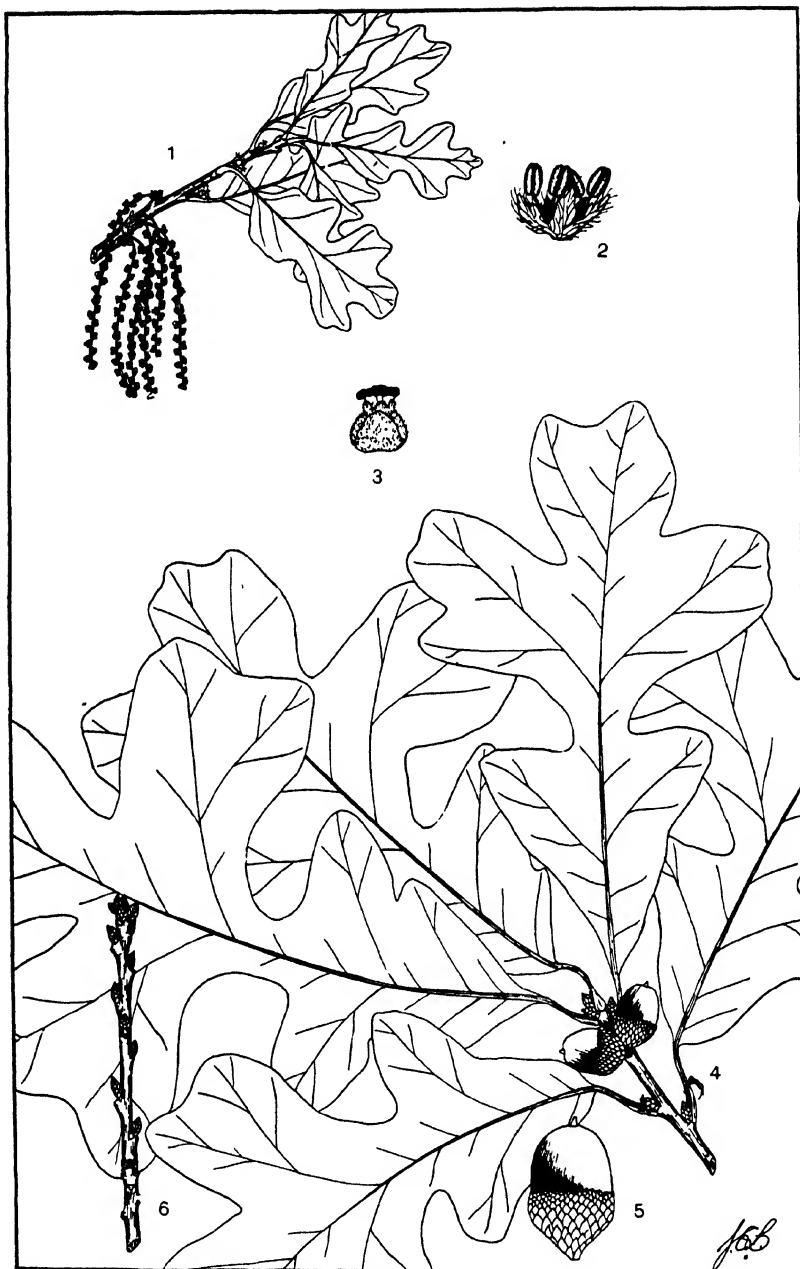
Winter characters—Twigs rather slender, pale-lenticellate, lustrous or somewhat glaucous, reddish gray becoming ashy gray the second season. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, reddish brown, about $\frac{1}{8}$ of an inch long. Mature bark light gray or nearly white, thick, divided by shallow fissures into long, irregular, thin scales.

Habitat—A cosmopolitan species growing on moist well-drained bottomlands, rich uplands, and stony ridges, preferring rich moist soil. Associated with other hardwoods (Oaks, Hickories, Yellow Poplar, etc.). Rarely mixed with conifers or in pure stands.

Range—Southern Maine through southern Ontario and the central portion of the Lower Peninsula of Michigan to southeastern Minnesota, south to northern Florida and eastern Texas.

Uses—An important lumber species producing the best grade of oak timber. Wood hard, heavy, strong, durable, pale brown with lighter sapwood. Prized for furniture, veneers, tight cooperage, car construction, railroad ties, etc.

*Var. *latiloba* Sarg. of *Quercus alba* L. is described here as this is the common northern form of this species. *Quercus alba* L. which also occurs in the Northeast, differs from the variety in possessing more dissected leaves with sinuses which often extend nearly to the base, and somewhat larger fruits with more strongly tuberculate cups. *Quercus alba* hybridizes with some of the other White Oaks.



Post Oak, Iron Oak

Quercus stellata Wagh. [*Quercus minor* (Marsh.) Sarg.;
Quercus obtusifolia Michx.]

- | | |
|---|---|
| 1. A twig showing pistillate and staminate flowers, and immature leaves x $\frac{1}{2}$ | 3. A pistillate flower, lateral view x 5 |
| 2. A staminate flower, lateral view x 5 | 4. A twig showing mature leaves and fruit x $\frac{1}{2}$ |
| | 5. Nut with cup, lateral view x 1 |
| | 6. Winter twig x $\frac{1}{2}$ |

FAGACEAE

Quercus stellata Wangh.* [*Quercus minor* (Marsh.) Sarg.;
Quercus obtusiloba Michx.]

Post Oak, Iron Oak

Habit—A medium-sized tree, usually 50—60 feet in height with a trunk diameter of 1—2 feet, under optimum conditions sometimes becoming 80—100 feet tall with a long, clean bole, in the northern limits of its range often reduced to a shrub. Crown broad, dense, round-topped, with stout spreading branches, much reduced in forest-grown specimens.

Leaves—Alternate, oblong-obovate, 4—5 inches long, 3—4 inches wide, broadly cuneate at the base, sinuately cut into 5—7 rounded, divergent lobes, the upper 3 much the larger, giving the leaf a cruciate appearance; terminal lobes often notched. At maturity the leaves are thick, firm, dark green above with scattered stellate hairs, rusty pubescent beneath. Petioles stout, pubescent, $\frac{1}{2}$ —1 inch in length.

Flowers—In the North appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers bracteolate, in interrupted, pendulous, deciduous aments $2\frac{1}{2}$ —4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, yellow, hirsute, with lacinate, acute lobes; stamens 4—6, with filiform, exerted filaments and yellow, notched anthers. Pistillate flowers sessile or pedunculate, borne in the axils of the leaves of the season, each subtended by broadly ovate, hirsute involucral scales; calyx campanulate, shallowly lobed, adnate to the ovary; pistil consisting of a 3-celled (rarely 4—5-celled) ovary surmounted by 3 short, dilated, red styles stigmatic on the inner surface.

Fruit—A sessile or pedunculate acorn, ripening in one season. Nut oval to ovoid or ovoid-oblong, obtuse and often pubescent at the apex, light chestnut-brown and frequently striate, $\frac{1}{2}$ —1 inch long, enclosed about one-third of its length in the cup. Cup turbinate or cup-shaped, downy within, consisting of numerous, thin, flat, tomentose scales.

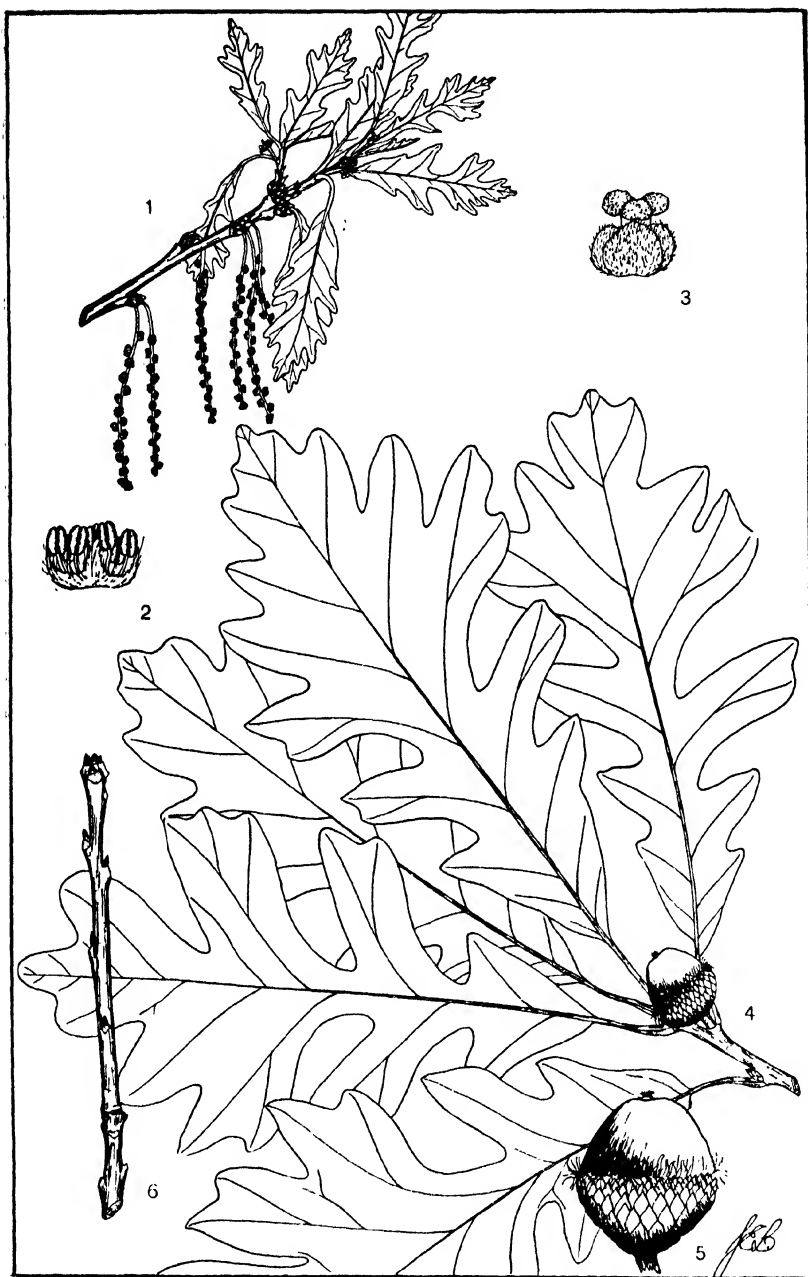
Winter characters—Twigs stout, pubescent, pale-lenticellate, orange to reddish brown, at length dark brown or nearly black. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, bluntly acute, chestnut-brown and pubescent, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark grayish brown, thick, divided by deep fissures into broad ridges which are scaly on the surface.

Habitat—An upland species preferring dry, sandy or gravelly sites. Thrives on limestone soils.

Range—Central New England (Cape Cod) westward through north central Ohio and southern Iowa to eastern Kansas, south to northern Florida and central Texas.

Uses—Wood hard, heavy, close-grained, durable, pale brown with lighter sapwood. Rather difficult to season. It is not distinguished in the trade from that of *Quercus alba* L. and is put to similar uses, although somewhat inferior.

*X *Quercus fernowii* Trel. is thought to be a hybrid between this species and *Quercus alba* L.



Bur Oak, Mossy-cup Oak, Over-cup Oak

Quercus macrocarpa Michx.

- | | |
|---|---|
| 1. A twig showing pistillate and staminate flowers, and immature leaves x $\frac{1}{2}$ | 3. A pistillate flower, lateral view x 5 |
| 2. A staminate flower, lateral view x 5 | 4. A twig showing mature leaves and fruit x $\frac{1}{2}$ |
| | 5. Nut with cup, lateral view x 1 |
| | 6. Winter twig x $\frac{1}{2}$ |

FAGACEAE

Quercus macrocarpa Michx.*

Bur Oak, Mossy-cup Oak, Over-cup Oak

Habit—One of the most widely distributed and largest of American oaks, under optimum conditions sometimes 170 feet in height with a trunk up to 7 feet in diameter which is free of branches for 50 feet or more, usually 70–80 feet in height and about 2½ feet in diameter, becoming shrubby at the northern limits of its range. Crown in the open broad and round-topped, with massive, spreading limbs and drooping, bushy branchlets. The tree coppices well.

Leaves—Alternate, obovate or oblong, 6–12 inches long, 3–6 inches wide, cuneate at the base, sinuately cut or nearly divided into 5–7 lobes, the terminal lobe much the larger and crenately lobed, the two middle sinuses frequently reaching nearly to the midrib. At maturity the leaves are thick, firm, lustrous and usually smooth above, whitish or grayish tomentulose below. Petioles stout, ¾–1 inch long.

Flowers—In the North appearing in late May or early June when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, hairy, filiform, pendulous, deciduous aments 4–6 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx hemi-spherical, yellowish green, pubescent, with 4–6 laciniate lobes; stamens 4–6, with short filaments and yellow, glabrous anthers. Pistillate flowers sessile or pedunculate, solitary or paired, borne in the axils of the leaves of the season, each subtended by broadly ovate, pubescent involucre scales; calyx campanulate, shallowly lobed, adnate to the ovary; pistil enclosed aside from the 3 spreading styles which are reddish and stigmatic on their inner surface.

Fruit—A sessile or short-pedunculate acorn, ripening the first season. Nut chestnut-brown, broadly ovoid or ellipsoid, rounded and finely pubescent at the apex, ¾–1½ (2 in the South) inches long, enclosed one-half or more of its length in the cup. Cup bowl-shaped, hoary-tomentose without, pale brown and pubescent within, with pointed, imbricated scales, the upper prolonged to form a fringe. Acorns are produced in abundance.

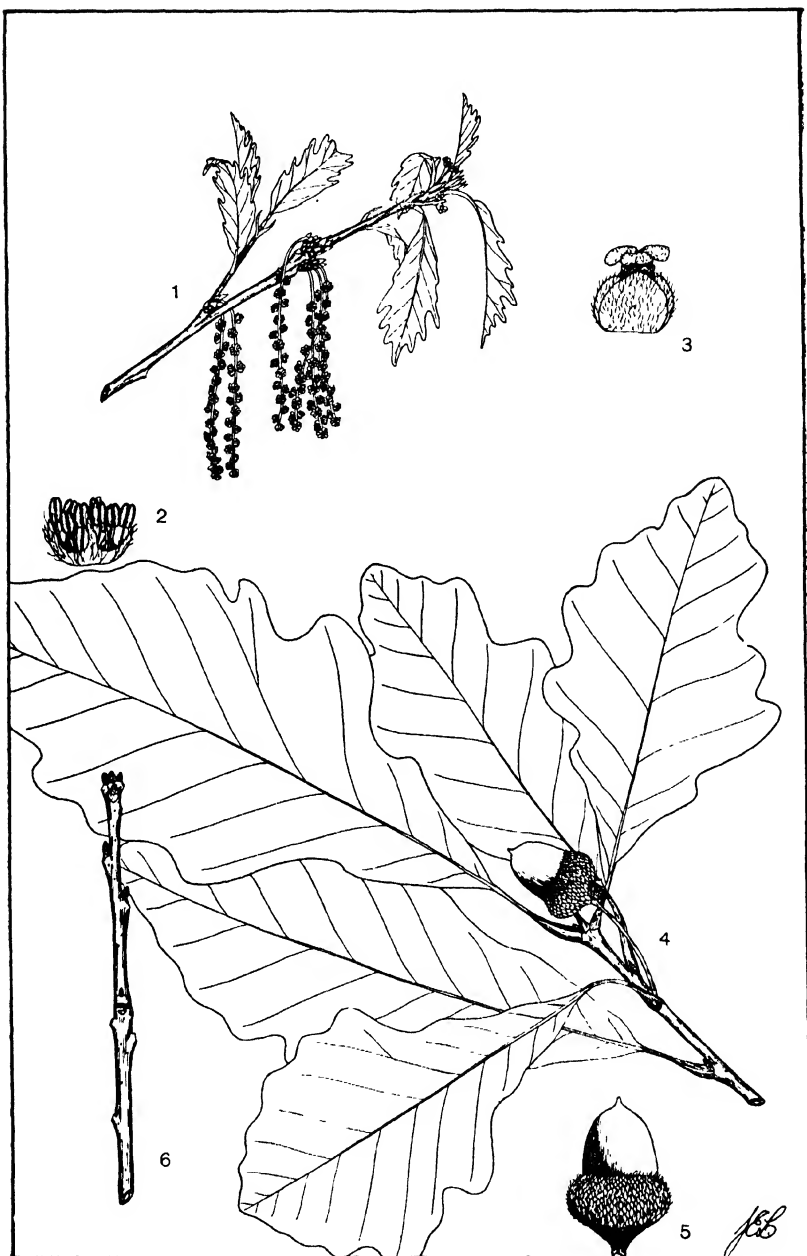
Winter characters—Twigs stout, pale-lenticellate, glabrous, pale orange-yellow, at length dark brown. Older twigs often develop corky wings. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, pubescent, pale reddish brown, ⅛–¼ of an inch long. Mature bark pale brown, medium thick, divided by deep furrows into irregular, scaly plates.

Habitat—An intolerant species. Prefers rich, deep, wet soils on bottom-lands and around swamps, associated with Soft Maple, Elm, etc., more rarely on drier, upland sites.

Range—Nova Scotia through central New Brunswick to the Sault Ste. Marie, thence westward to southern Manitoba, in all the northern border states from Maine to eastern Montana, south to Delaware, western Tennessee and south-central Texas.

Uses—A valuable timber species producing lumber equivalent in quality to that of White Oak. Wood hard, heavy, strong, durable, rich brown with paler sapwood. Prized for furniture, veneers, interior finish, cooperage, railroad ties, etc. The tree is sometimes used as an ornamental and is especially resistant to smoke and gases.

*A number of hybrids between this species and other White Oaks have been described.



Swamp White Oak

Quercus bicolor Willd. [*Quercus platanoides* (Lam.) Sudw.]

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit, $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times \frac{3}{4}$
(the long stem is not shown)
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus bicolor Willd.* [*Quercus platanoides* (Lam.) Sudw.]

Swamp White Oak

Habit—A tree usually 60—70 feet high when mature with a trunk 2—3 feet in diameter, occasionally under optimum conditions 100 feet tall. In the open the crown is broad, open, and round-topped, with basal drooping branches with bark exfoliating in thin strips which give the tree a bizarre appearance. In dense stands the bole is free of branches for some distance, continuing well into the crown.

Leaves—Alternate, obovate or oblong-obovate, 5—6 inches long, 2—4 inches wide, usually rounded at the apex, cuneate at the base, coarsely sinuate-crenate or occasionally pinnatifid, at maturity thick, firm, dark green and lustrous above, pale or often silvery white or tawny below, borne on stout petioles $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—Appearing in late May or early June when the leaves are about one-fourth developed, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3—4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, pale yellowish green, pubescent, deeply cut into 5—9 lanceolate segments; stamens 5—9, with slender filaments and glabrous, yellow anthers. Pistillate flowers in few-flowered, white-tomentose, pedunculate spikes borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucre scales; calyx campanulate, adnate to the ovary, shallowly lobed above; pistil consisting of a 3-celled (rarely 4—5-celled) ovary surmounted by 3 short styles stigmatic on their inner surface.

Fruit—An acorn, borne solitary or in pairs on a peduncle $1\frac{1}{2}$ —3 inches long, ripening the first season. Nut ovoid to ovoid-oblong, light chestnut-brown, rounded, abruptly pointed and pubescent at the apex, $\frac{3}{4}$ — $1\frac{1}{4}$ inches long, enclosed about one-third of its length in the cup. Cup broadly turbinate to cup-shaped, thick, woody, hoary-tomentose without and often tuberculate toward the base, frequently with a fringed margin, pale brown and pubescent within. Seed years infrequent.

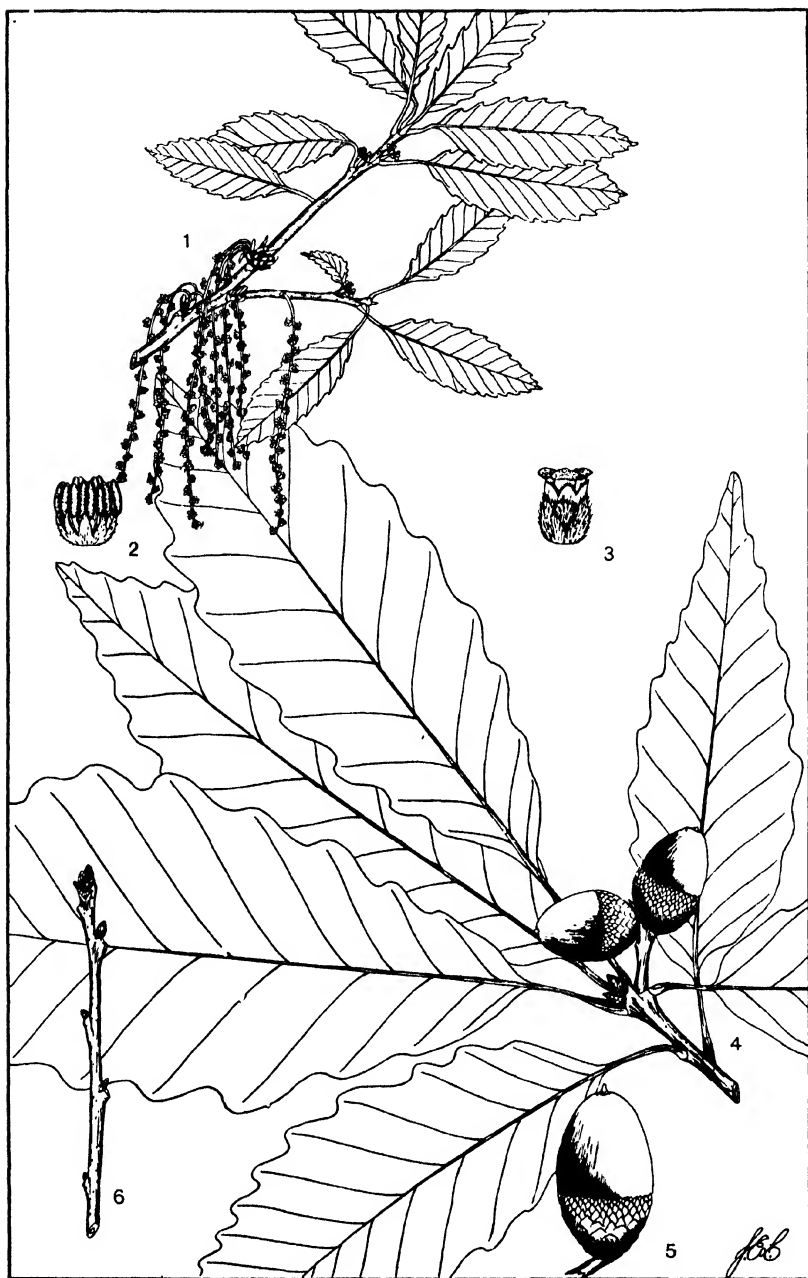
Winter characters—Twigs stout, pale-lenticellate, smooth or puberulous, yellow or reddish brown, at length darker and glaucous. Bark on older branches exfoliating in thin strips. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, pale chestnut-brown, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark grayish brown, thick, divided by deep fissures into long, flat ridges scaly at the surface.

Habitat—A bottom-land species preferring wet, fertile soils along stream borders, the edges of swamps, and low, poorly drained pastures. Frequently associated with Red Maple, Black Ash, Pin and Bur Oaks, gums, etc.

Range—Southern Maine westward through southern Ontario and the Lower Peninsula of Michigan to southeastern Minnesota, southward through southeastern Nebraska to Arkansas, thence northeast through northern Kentucky and West Virginia to the Coast.

Uses—Wood heavy, hard, strong, close-grained, pale brown with lighter sapwood. It compares favorably with that of White Oak and is used for similar purposes, but is more inclined to knots.

*X *Quercus jacklana* Schneid. = *Quercus bicolor* X *Quercus alba* L.; X *Quercus schuettei* Trel. = *Quercus bicolor* X *Quercus macrocarpa* Michx.



Chestnut Oak

Quercus montana Willd. [*Quercus prinus* Engelm., not L.]

- | | |
|--|--|
| 1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$ | 3. A pistillate flower, lateral view $\times 5$ |
| 2. A staminate flower, lateral view $\times 5$ | 4. A twig showing mature leaves and fruit $\times \frac{1}{2}$ |
| | 5. Nut with cup, lateral view $\times \frac{3}{4}$ |
| | 6. Winter twig $\times \frac{1}{2}$ |

FAGACEAE

Quercus montana Willd.* [*Quercus prinus* Engelm., not L.]

Chestnut Oak

Habit—Usually 60–70 feet in height with a trunk diameter of 3–4 feet, rarely under favorable conditions 100 feet tall and 7 feet through at the butt. In the open the bole breaks up 15–20 feet above the ground into stout, spreading limbs which form a broad, low, open, rounded crown. Trees under forest conditions have a stout, columnar bole which continues well into the high, reduced crown. Stump-sprouts are produced in abundance.

Leaves—Alternate, obovate to oblong or lanceolate, 4–9 inches long, $1\frac{1}{2}$ –3 inches wide, acute or acuminate or rounded at the apex, cuneate or rounded or subcordate at the base, coarsely crenate-dentate or repand-crenate, at maturity thick, firm, yellowish green and somewhat lustrous above, pale and somewhat pubescent beneath, borne on stout or slender petioles $\frac{1}{2}$ –1 inch long.

Flowers—Appearing in late May or early June when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2–3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, light yellow, pubescent, deeply cut into 7–9 acute lobes; stamens 7–9, with slender glabrous filaments and oblong, glabrous, notched, bright yellow anthers. Pistillate flowers in groups of 2–3 (occasionally solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucreal scales; calyx campanulate, adnate to the ovary, with shallow, ciliate lobes; pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short, dilated, spreading, reddish styles stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs on a short peduncle, ripening the first season. Nut ovoid to ellipsoidal, light chestnut-brown and lustrous at maturity, rounded and abruptly pointed at the apex, 1– $1\frac{1}{2}$ inches long, enclosed for one-third to one-half of its length in the cup. Cup cup-shaped, hoary-pubescent without, reddish brown and pubescent within, the scales toward the base tuberculate.

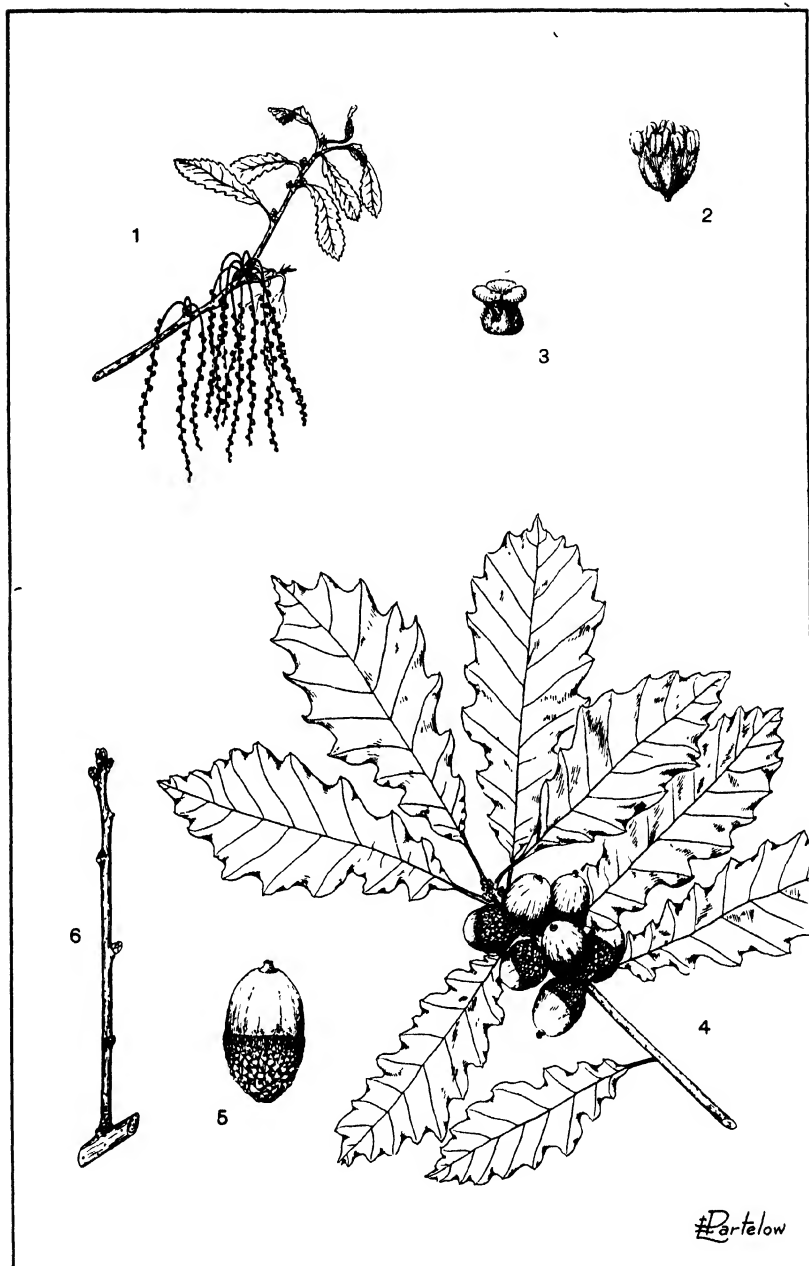
Winter characters—Twigs stout, bitter, pale-lenticellate, smooth, orange to reddish brown, becoming brown or dark brown the second year. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate-conical, acute, light chestnut-brown and pilose, $\frac{1}{4}$ – $\frac{1}{2}$ of an inch long. Mature bark dark reddish brown to nearly black, thick, very rough, characteristically divided by deep fissures into broad, rounded, continuous, longitudinal ridges, scaly at the surface.

Habitat—Predominantly an upland species preferring well-drained sites on ridges, wooded hilltops, the sides of high rocky glens, climbing higher near the southern limits of its range. Occasional on well-drained bottomlands where it makes the best growth. Often associated with Chestnut and Black Oak on upper slopes and exposed ridges.

Range—Southern Maine through central New York to southern Indiana, south along the coast to the District of Columbia and in the mountains to northern Georgia and northern Alabama. Sporadic in southern Michigan, in Illinois, and in northeastern Mississippi.

Uses—Wood heavy, hard, strong, close-grained, durable in contact with the soil, dark brown with paler sapwood, somewhat inferior to that of White Oak in value. Used for construction, railroad ties, fencing, etc. Tannin is sometimes obtained from the bark.

*A hybrid, *X Quercus saullii* Schneid., has been described between this species and *Quercus alba* L.



Dwarf Chinquapin Oak, Scrub Chestnut Oak

***Quercus prinoides* Willd. [*Quercus chinquapin* Pursh.]**

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus prinoides Willd. [*Quercus chinquapin* Pursh.]

Dwarf Chinquapin Oak, Scrub Chestnut Oak

Habit—Usually a low, spreading shrub 2–5 feet in height, generally in clumps but occasionally solitary, rarely a small tree up to 18 feet in height with a broad crown and a trunk reaching a diameter of 4 inches. Similar to Chinquapin Oak, *Quercus muhlenbergii* Engelm., but lower in stature with smaller, shorter-petioled leaves with more undulate margins, and deeper acorn-cups with more tumid scales.

Leaves—Alternate, obovate or less frequently obovate-oblong, 2–6 inches long, 1–2 inches wide, acute or short-acuminate at the apex, cuneate or less frequently rounded at the base, coarsely toothed with 3–7 pairs of acute or obtusish teeth or undulate-dentate, at maturity bright green and glabrous above, grayish-tomentulose beneath, borne on short, stout petioles $\frac{1}{3}$ – $\frac{1}{2}$ ths of an inch long.

Flowers—In the Northeast, appearing in late May or early June when the leaves are about $\frac{1}{3}$ th grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments $1\frac{1}{2}$ – $2\frac{1}{2}$ inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, yellowish green, pubescent, deeply cut into 4 acute lobes; stamens 4–8, with short, smooth filaments and yellow, oblong, notched anthers. Pistillate flowers solitary or in clusters of 2–3 on short peduncles, pubescent, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucreal scales; calyx campanulate, adnate to the ovary; pistil consisting of a 2–4-celled ovary surmounted by 2–4 short, spreading, reddish styles stigmatic on the inner surface.

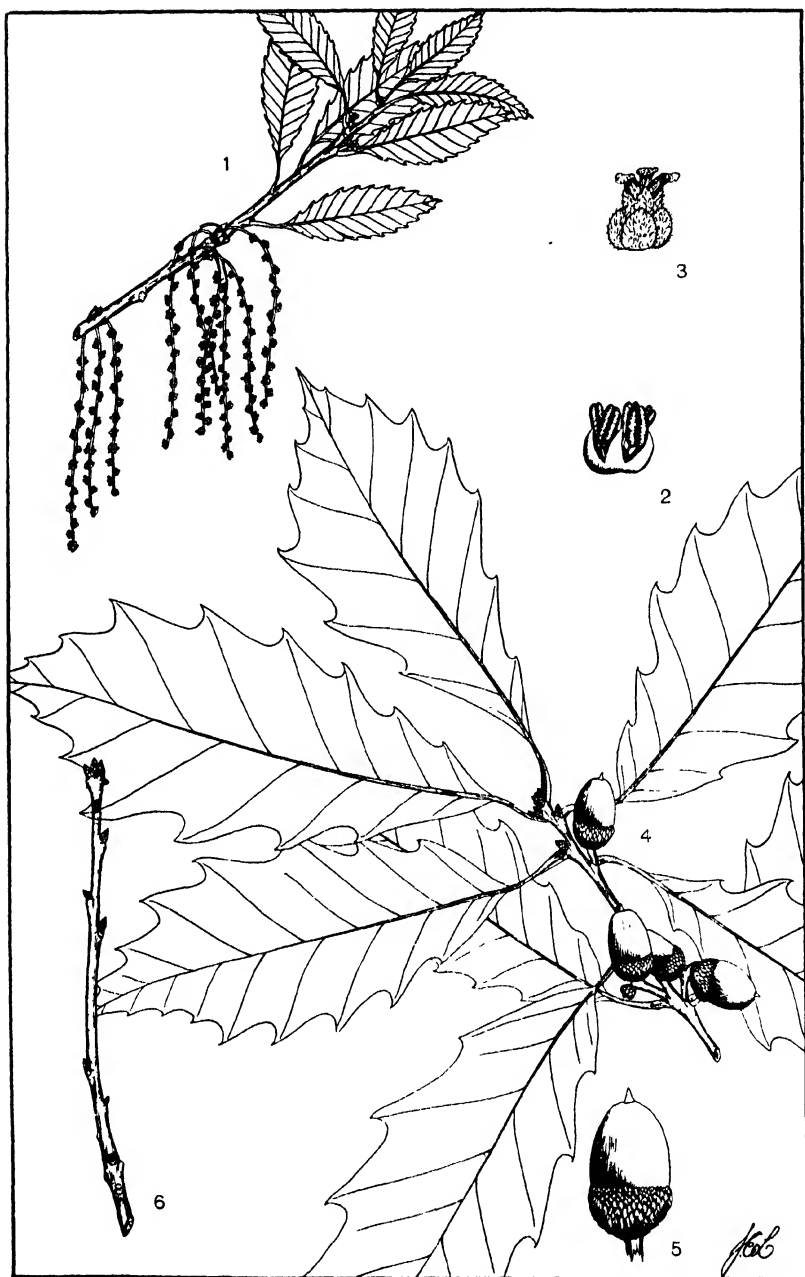
Fruit—An acorn, borne solitary or in pairs on a short peduncle, ripening the first season. Nut ovoid, green and striated with dark longitudinal lines when young, turning dark chestnut brown as it matures, greyish tomentulose toward the tip, abruptly pointed at the apex, $\frac{1}{3}$ – $\frac{1}{2}$ ths of an inch long, enclosed for about one-half of its length in the cup. Cup bowl-shaped, rather thick and deep, pale-woolly without, pubescent within, the scales toward the base tuberculate.

Winter characters—Twigs medium slender (for an oak), pale-lenticellate, smooth, reddish brown, becoming brownish gray or gray the second season. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, rounded at the apex, light chestnut-brown, covered with thin imbricated scales which are ciliate on the margin, about $\frac{1}{8}$ th of an inch long. Mature bark thin, bitter, light brown marked by light gray blotches, smooth at first but eventually becoming rough in trees 3–4 inches in diameter.

Habitat—Dry sandy or rocky soils in hillside pastures, moist woods, and pine barrens.

Range—Massachusetts to North Carolina, westward to Minnesota, southeastern Nebraska, central Kansas, Oklahoma and eastern Texas.

Uses—A 'weed' species of no commercial value because of its small size. Less abundant within its range than Scrub Oak, *Quercus ilicifolia* Wagh., and hence less troublesome in forest operations. The acorns are eaten by rodents.



Chinquapin Oak, Chestnut Oak, Yellow Oak

Quercus muhlenbergii Engelm. [*Quercus acuminata* Sarg., not Roxb.]

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus muhlenbergii Engelm. [*Quercus acuminata* Sarg., not Roxb.]

Chinquapin Oak, Chestnut Oak, Yellow Oak

Habit—In our range a shrub or small tree 20—50 feet in height with a trunk $\frac{1}{2}$ —2 feet in diameter, in southern Indiana and Illinois attaining an optimum development of 100—160 feet with a tall, straight trunk up to 4 feet in diameter at the base. Crown narrow, round-topped. Bole often buttressed below.

Leaves—Alternate, oblong-lanceolate to broadly obovate, 4—7 inches long, 1—5 inches wide, pointed at the apex, cuneate or rounded at the base, coarsely and regularly serrate except at the base with 8—13 pairs of acute and mucronate, often incurved teeth, at maturity thick, firm, glabrous, yellowish green above, pale silvery-pubescent below, borne on slender, nearly terete petioles $\frac{3}{4}$ —1 $\frac{1}{2}$ inches long. The leaves of this species resemble those of Chestnut, *Castanea dentata* (Marsh.) Borkh., more closely than any other oak.

Flowers—In the Northeast appearing in late May or early June when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3—4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, yellow, pubescent, deeply divided into 5—6 acute lobes; stamens as many as the calyx-lobes, with short smooth filaments and yellow, oblong, notched anthers. Pistillate flowers clustered, sessile or pedunculate, white-tomentose, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucreal scales; calyx campanulate, adnate to the ovary, shallowly lobed above; pistil consisting of a 3-celled (rarely 4—5-celled) ovary surmounted by 3 bright red styles stigmatic on their inner surface.

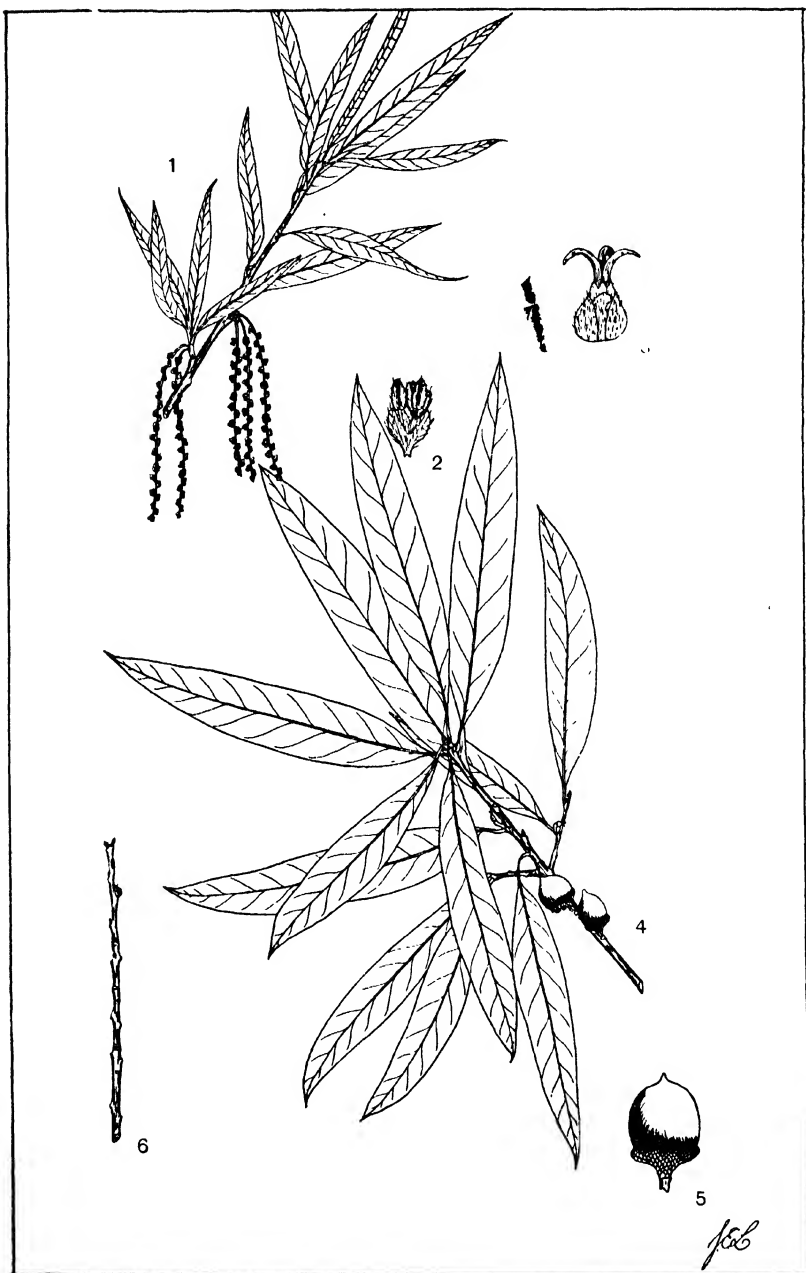
Fruit—An acorn, borne solitary or in pairs on a short peduncle or sessile, ripening the first season. Nut broadly ovoid, pale chestnut-brown, rounded and abruptly pointed at the apex, $\frac{1}{2}$ —1 inch long, enclosed from one-third to one-half of its length in the cup. Cup bowl-shaped, thin, hoary-tomentose without, pale brown and pubescent within, with small obtuse scales.

Winter characters—Twigs slender, pale-lenticellate, smooth, grayish or reddish brown, at length brownish gray. Buds alternate, chestnut-brown, those near the branch-tip $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark gray or nearly white, thin, shallowly fissured into flat-topped, scaly ridges, approaching in appearance that of *Quercus alba* L.

Habitat—In the Northeast, a small upland tree preferring barren limestone ridges and ledges, becoming a large tree in the river valleys of the Central States, notably in the valley of the Wabash River.

Range—Lake Champlain and western Massachusetts to northern Iowa, southward to northwestern Florida and central Texas. Not on the coastal plain or in the Piedmont Region below Maryland except in Florida.

Uses—Wood hard, heavy, strong, close-grained, durable in contact with the soil, dark brown with pale sapwood. Similar to that of the other White Oaks and used for wagonry, cooperage, railroad ties, fuel, etc. Of minor importance in the Northeast because of its small stature.



Willow Oak

Quercus phellos L.

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{1}{6}$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE
Quercus phellos* L.

Willow Oak

Habit—A tree under optimum forest conditions occasionally 90 feet in height, with a trunk diameter up to 4 feet and a restricted crown, in the open usually 50—60 feet tall at maturity with a narrow, usually open, round-topped, pyramidal crown.

Leaves—Alternate, linear-oblong to lanceolate, $2\frac{1}{2}$ —5 inches long, $\frac{1}{4}$ —1 inch wide, sharply acute and bristle-pointed at the apex, acute at the base, entire or slightly undulate, at maturity firm, light green, glabrous and lustrous above, paler and smooth or rarely hoary-pubescent below, borne on stout petioles about $\frac{1}{8}$ or an inch long.

Flowers—In the North appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers, in interrupted, filiform, pendulous, hairy aments 2—3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, yellow, pubescent, deeply cut into 4—5 ovate, acute lobes; stamens 4—5, the anthers oblong, hairy, slightly apiculate. Pistillate flowers solitary or paired, pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, brown, hairy involucre scales; calyx adnate to the ovary, the lobes shallow and acute; styles elongated, spreading, strap-shaped, bright red, stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs, sessile or short-pedunculate, ripening the second season. Nut hemispherical globose-oboid, pale yellowish brown and pubescent at maturity, rounded and abruptly pointed at the apex, about $\frac{2}{3}$ of an inch long, enclosed only at the base in the cup. Cup saucer-shaped, thin, pale reddish brown and hoary-pubescent without, silky-pubescent within.

Winter characters—Twigs slender, dark-lenticellate, glabrous, lustrous, reddish brown, at length dark reddish or grayish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, chestnut-brown, about $\frac{1}{8}$ of an inch long. Mature bark reddish brown, thin, divided by shallow fissures into irregular plates, scaly on the surface.

Habitat—Chiefly a bottomland or swamp species preferring moist sites along stream courses and swamp borders, more rarely in well-drained, sandy, upland situations where a plentiful supply of moisture is assured.

Range—Staten Island, N. Y., south through the maritime belt to Florida, west through the Gulf States to eastern Texas, northward in the Mississippi Valley through eastern Oklahoma and southeastern Missouri to southern Illinois and western Kentucky.

Uses—A timber species. Wood medium hard, heavy, strong, coarse-grained, pale reddish brown with lighter sapwood. Used for the same purposes as the other Red Oaks. This species is planted as an ornamental and shade tree in the South.

**Quercus heterophylla* Michx. is considered to be a hybrid between this species and *Quercus borealis* var. *maxima* Sarg. *Quercus phellos* X *Quercus palustris* L. = X *Quercus schochiana* Dick.



Black Jack Oak, Barren Oak

Quercus marilandica Muench. [*Quercus nigra* Wagh., not L.]

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus marilandica Muench. [*Quercus nigra* Wagh., not L.]

Black Jack Oak, Barren Oak

Habit—Usually a small tree 20—40 feet in height with a trunk diameter of 6—12 inches, under favorable conditions sometimes 40—50 feet tall. Crown in the open narrow and round-topped with wide-spreading and somewhat pendulous branches, much restricted under forest conditions.

Leaves—Alternate, broadly obovate, rounded or cordate at the base, 3- (rarely 5-) lobed at the apex, the lobes rounded or acute, entire or dentate and bristle-tipped. At maturity the leaves are thick, firm, dark yellowish green and very lustrous above, and rusty brown and scurfy-pubescent below. Petioles stout, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—In our range appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2—4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, reddish green, pubescent, deeply divided into 4—5 broad, ovate, rounded lobes; stamens 4—5, with oblong, apiculate, glabrous, dark red anthers. Pistillate flowers solitary or paired, pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, rusty-tomentose involucreal scales; calyx adnate to the ovary, its lobes shallow and acute; stigmas spatulate, reflexed, dark red.

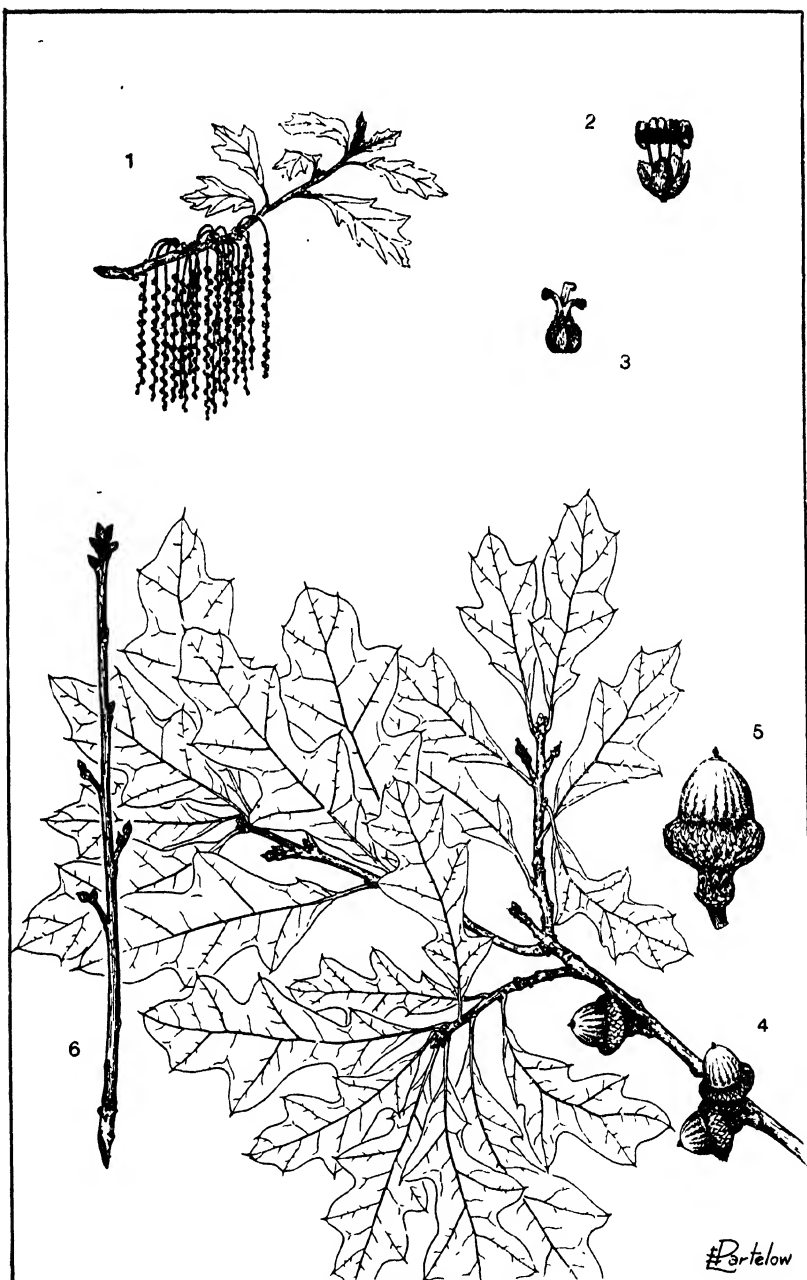
Fruit—An acorn, borne solitary or in pairs, generally on a stout peduncle, ripening the second season. Nut ovoid to ovoid-oblong, light yellow-brown and often striate, rounded and abruptly pointed at the apex, $\frac{2}{3}$ — $\frac{1}{2}$ of an inch long, enclosed for about half of its length in the cup. Cup turbinate, thick, reddish brown without, pale brown and puberulous within, its scales tomentose and loosely imbricated.

Winter characters—Twigs stout, pale-lenticellate, smooth or puberulous, reddish brown, at length dark brown or gray. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute-angled, pubescent, reddish brown, about $\frac{1}{4}$ of an inch long. Mature bark dark brown or black, thick, rough with deep fissures separating squarish plates 1—3 inches in diameter.

Habitat—In the range of this text a tree of the sand barrens, preferring dry, sterile soils where conditions are adverse for most tree species.

Range—Long Island, N. Y., westward through central Pennsylvania, southern Michigan, northern Illinois and southern Iowa to southeastern Nebraska, south to northern Florida and eastern Texas. Uncommon in the North, abundant southward and west of the Mississippi, often forming an appreciable part of the forest.

Uses—The tree is of no commercial value in the Northeast. Wood hard, heavy, strong, dark brown with paler sapwood. In the South it is used for fuel and railroad ties, and is occasionally manufactured into lumber.



Scrub Oak, Bear Oak

Quercus ilicifolia Wangh. [*Quercus nana* (Marsh.) Sarg.]

1. A twig showing pistillate and staminate flowers, and immature leaves x $\frac{1}{2}$
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x $\frac{1}{2}$
5. Nut with cup, lateral view x 1
6. Winter twig x $\frac{1}{2}$

FAGACEAE

Quercus ilicifolia Wagh.[*Quercus nana* (Marsh.) Sarg.]

Scrub Oak, Bear Oak

Habit—A much-branched, scraggly shrub with many tough, crooked, interlacing branches, occasionally a small tree 18–20 feet in height with a round-topped spreading head and a trunk 5–6 inches in diameter. Frequently forming dense thickets over wide areas.

Leaves—Alternate, obovate or rarely oblong, 2–5 inches long, $1\frac{1}{2}$ –3 inches wide, gradually or abruptly wedge-shaped at the base, often with bristle-tipped lobes separated by wide shallow sinuses and the margin variable in contour [the lobes frequently 3–7 (mostly 5)], at other times slightly 3-lobed at the apex and entire below, or deeply 3-lobed above and sinuate below, or nearly entire with undulate margins, at maturity thick, firm, dark green and lustrous above, covered with pale- or silvery-white pubescence below, borne on slender, nearly terete, glabrous or pubescent petioles 1– $1\frac{1}{2}$ inches long. .

Flowers—In the northern portion of its range appearing in late May and early June when the leaves are about one-fourth grown. Staminate flowers in interrupted, filiform, pendulous aments $1\frac{1}{2}$ –3 inches long which are borne on the growth of the preceding season or from the axils of the scales of the terminal bud and often persist until mid-summer; calyx campanulate, red or green tinged with red, pubescent, irregularly divided into 3–5 ovate, rounded lobes which are shorter than the stamens; stamens as many as the calyx-lobes, with smooth filaments and bright red (at length yellow) anthers. Pistillate flowers solitary or 2- several on stout, tomentose peduncles, borne in the axils of the leaves of the season, each subtended by ovate, red, hairy involucre scales; calyx adnate to the ovary, the acute lobes scarcely longer than the involucre scales; pistil consisting of a 3-celled ovary surmounted by 3 dark red styles stigmatic on their inner surface.

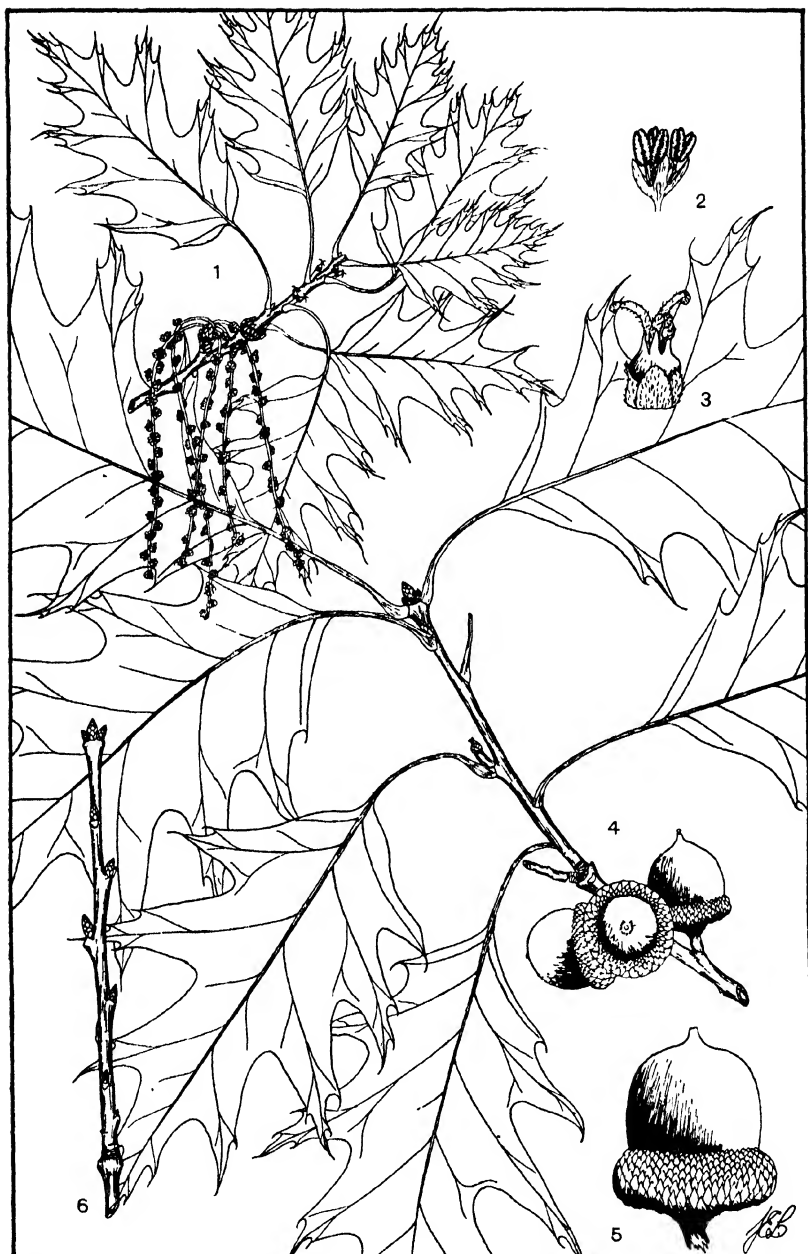
Fruit—An acorn, produced in great profusion, borne in pairs or rarely solitary, sessile or stalked, ripening the second season. Nut ovoid, light brown, lustrous and usually faintly striate, rounded and abruptly pointed at the apex, about $\frac{1}{2}$ inch long, enclosed for about one-half its length in the cup. Cup thick, often abruptly enlarged above the stalk-like base, light reddish brown within, covered without by thin, narrowly ovate, acute, reddish brown, puberulous scales, the minute free tips of the upper scales forming a fringe-like border to the cup.

Winter characters—Twigs slender, with minute inconspicuous lenticels, yellowish green to reddish brown, at first covered with greenish yellow to reddish brown tomentum which usually disappears from exposed parts during the winter but may persist in protected parts near the twig-apex, at length dark brown and smooth. Leaf-petioles frequently breaking off above the place of attachment, the spur persisting throughout the winter. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate to conical, obtuse or acute, usually not over $\frac{1}{4}$ th of an inch long. Mature bark thin, smooth, dark brown, covered with small, closely appressed scales.

Habitat—Dry sand barrens along the coast, on rocky hillsides, and on the barren, dry, infertile soils of plateaus and mountain tops. Intolerant of much shade. Often covers extensive tracts where the forest has been opened up by lumbering operations or following forest fires.

Range—Maine through eastern and southern New England to southern and southwestern Pennsylvania and Virginia, westward to Ohio and Kentucky.

Uses—Not a source of timber because of its small size. The chief value of this species depends upon its ability to grow upon exposed and inhospitable sites where it serves as a 'cover-tree' until displaced by more valuable species. Dense thickets of scrub oak afford excellent cover for game during the summer months.



Red Oak

Quercus borealis var. *maxima* (Marsh) Ashe [*Quercus rubra* Du Roi, not L.]

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{1}{8}$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus borealis var. *maxima* (Marsh.) Ashe* [*Quercus rubra* Du Roi, not L.]

Red Oak

Habit—Under optimum conditions one of the largest of the oaks, attaining a height of 150 feet, usually 60–70 feet in height with a trunk diameter of 2–3 feet. In the open the trunk is short and massive, soon breaking up into stout limbs to form a broad, symmetrical crown. In dense stands the bole continues into the narrow, round-topped head.

Leaves—Alternate, oblong to obovate, 5–9 inches long, 4–6 inches wide, acute or acuminate at the apex, cuneate or rounded at the base, 7–11-lobed, the lobes usually sinuately 3-toothed and bristle-tipped and separated by wide, rounded, oblique sinuses which extend about half way to the midrib. At maturity the leaves are thin, firm, glabrous, dull dark green above, paler and glabrous or puberulous below. Petioles stout, 1–2 inches long.

Flowers—In the North appearing in late May or early June when the leaves are about half grown, monoecious. Staminate flowers pedunculate in interrupted, filiform, pendulous, hairy aments 4–5 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, green, pubescent, deeply cut into 4–5 narrow, ovate lobes; stamens 4–5, with large, oblong, emarginate, yellow anthers. Pistillate flowers in groups of 2–3 (occasionally solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy, involucre scales; calyx adnate to the ovary, with lanceolate acute lobes; pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 elongated, spreading, strap-shaped, green styles stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs, sessile or on a short, stout peduncle, ripening the second season. Nut ovoid to slightly obovoid, chestnut-brown and lustrous at maturity, rounded and abruptly pointed at the apex, 1–1¼ inches long, enclosed for about one-fourth of the length in the cup. Cup saucer-shaped, thick, reddish brown, lustrous and puberulous without, reddish brown and pubescent within.

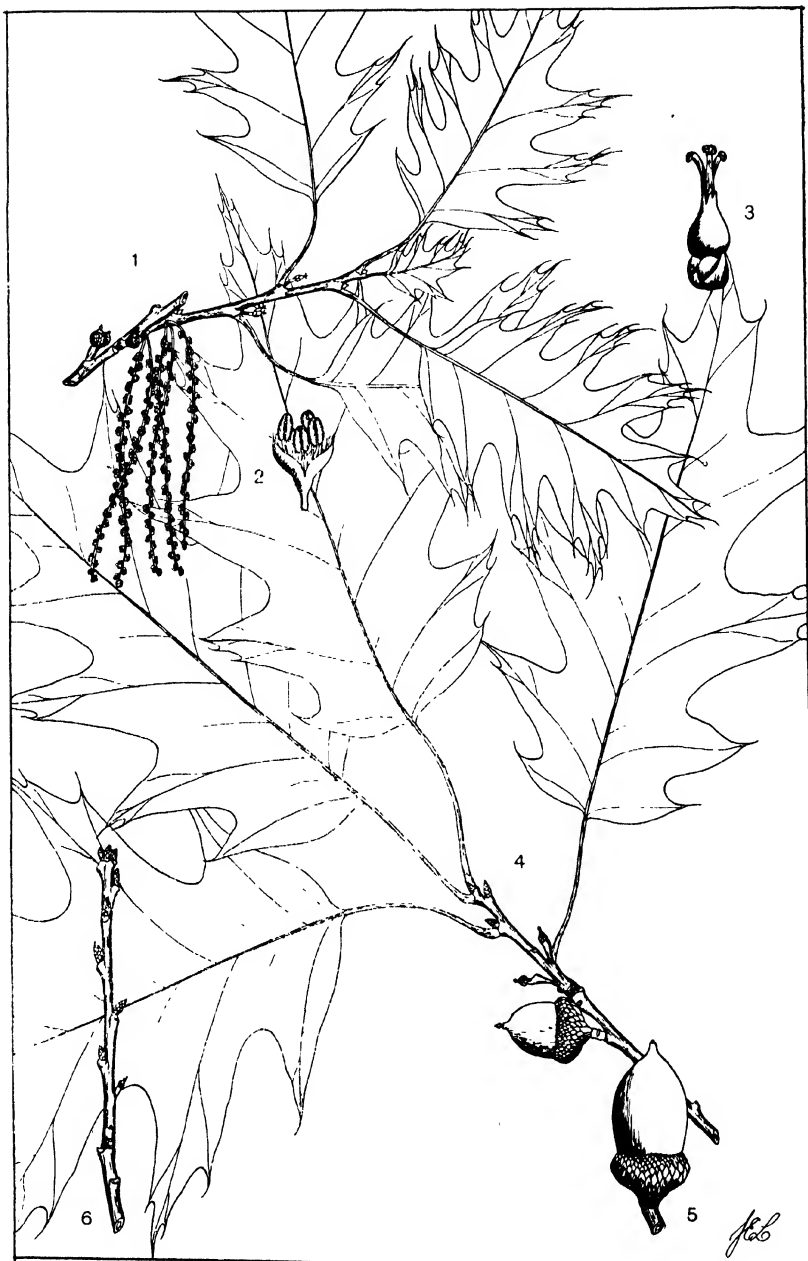
Winter characters—Twigs slender, pale-lenticellate, smooth, dark red, at length reddish or greenish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, light chestnut-brown, about ¼ of an inch long. Mature bark dark brown, thick, divided by shallow fissures into regular, continuous, flat-topped ridges scaly at the surface.

Habitat—Requires a well-drained site, thriving best on gravelly or sandy loams but not exacting as to soil requirements.

Range—Province of Quebec near Montreal through southern Ontario and southern Michigan to southeastern Nebraska, southward into Georgia, Alabama, Mississippi, Arkansas, and Oklahoma. Rare and local in the South.

Uses—Wood hard, heavy, strong, close-grained, pale reddish brown with paler sapwood. Used for construction, furniture, interior finish, railroad ties and timbers, but less durable and inferior to that of the White Oaks. The most rapidly growing form of oak, recommended over others in silvicultural practice. Often planted as a shade and park tree in the Northeast and generally more successful in Europe than the other American oaks.

*The following hybrids are reported: *Quercus borealis* var. *maxima* X *Quercus imbricaria* Michx. = X *Quercus runcinata* Engelm.; *Quercus borealis* var. *maxima* X *Quercus coccinea* Muench. = X *Quercus benderi* Baen.; *Quercus borealis maxima* X *Quercus palustris* L. = X *Quercus richteri* Baen.



Northern Red Oak

Quercus borealis Michx. f. [*Quercus ambigua* Michx. f.; *Quercus rubra* var. *ambigua* Fern.]

1. A twig showing pistillate and staminate flowers, and immature leaves x $\frac{1}{2}$
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 6
4. A twig showing mature leaves and fruit x $\frac{1}{2}$
5. Nut with cup, lateral view x 1
6. Winter twig x $\frac{1}{2}$

FAGACEAE

Quercus borealis Michx. f. [**Quercus ambigua** Michx. f.; **Quercus rubra** var. **ambigua** Fern.]

Northern Red Oak

Habit—Similar in habit to the common Red Oak, **Quercus borealis** var. **maxima** (Marsh.) Ashe but never attaining to the maximum size of that variety. A tree usually 50—60 feet in height with short, massive trunk, stout limbs, and a broad, symmetrical, rounded crown.

Leaves—Similar to those of the common Red Oak.

Flowers—Appearing in early June. Comparable to those of the common Red Oak.

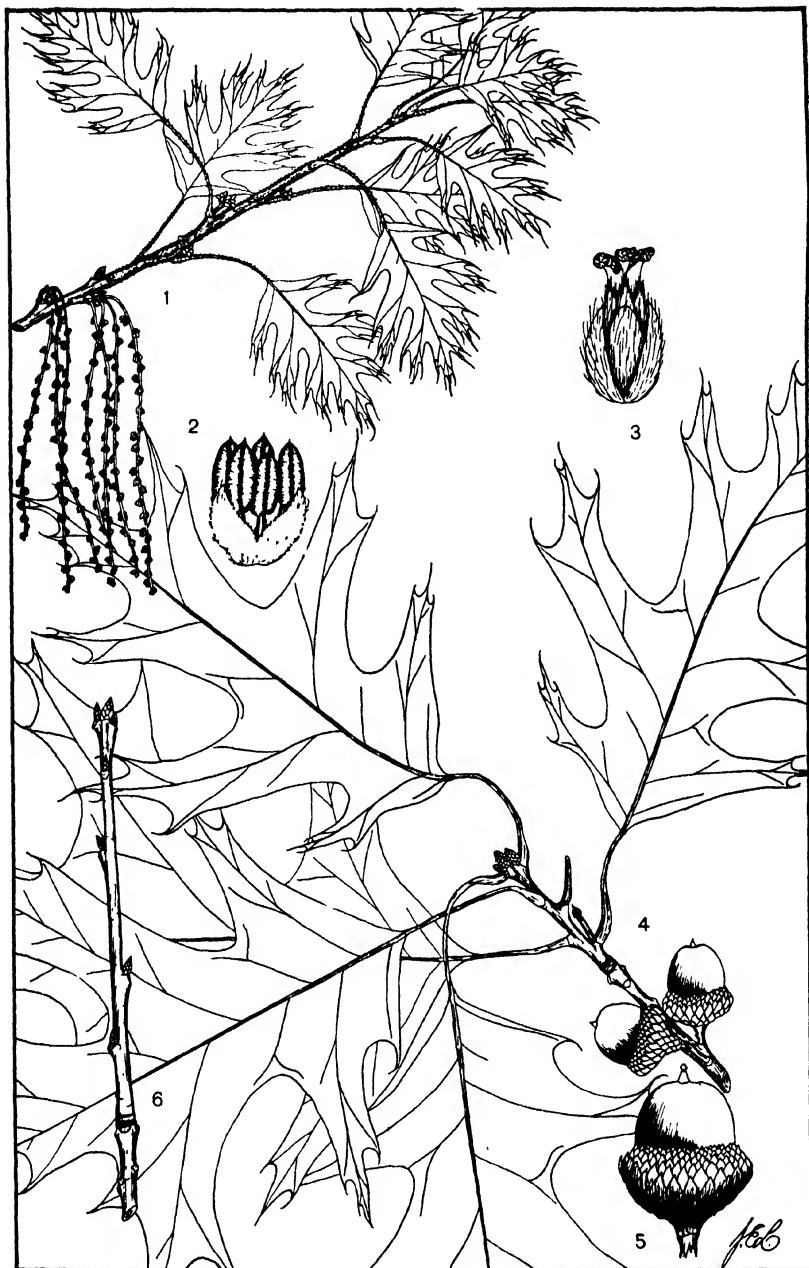
Fruit—Smaller than that of the common Red Oak. Nut ovoid, pale brown and lustrous at maturity, narrowed and pointed at the apex, more or less tomentose toward the ends, $\frac{1}{2}$ —1 inch long, enclosed for one-fourth to one-third of its length in the cup. Cup turbinate or cup-shaped, thick, reddish brown and nearly smooth without, reddish brown and pubescent within.

Winter characters—Similar to those of the common Red Oak.

Habitat—An upland species preferring well-drained sites but not exacting as to soil requirements.

Range—Insufficiently known but much less common in the Northeast than **Quercus borealis** var. **maxima** (Marsh.) Ashe. Said to occur from Nova Scotia west through southern Quebec to the northern shores of Lake Huron, southern Wisconsin, and central Minnesota, south to Arkansas, eastern Tennessee, western North Carolina, and central Virginia.

Uses—The wood is said to be stronger and more durable than that of Red Oak but it not distinguished from the wood of this variety in the trade.



Black Oak, Yellow-bark Oak

Quercus velutina Lam. [*Quercus tinctoria* Bartr.]

- | | |
|--|--|
| 1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$ | 3. A pistillate flower, lateral view $\times 5$ |
| 2. A staminate flower, lateral view $\times 5$ | 4. A twig showing mature leaves and fruit $\times \frac{1}{2}$ |
| | 5. Nut with cup, lateral view $\times 1$ |
| | 6. Winter twig $\times \frac{1}{2}$ |

FAGACEAE

Quercus velutina Lam.* [*Quercus tinctoria* Bartr.]

Black Oak, Yellow-bark Oak

Habit—One of the commonest and most variable oaks of the North-eastern States. A tree usually 60—80 feet in height with a trunk diameter of 3—4 feet, in the lower Ohio Basin sometimes 150 feet in height. Crown oblong, irregular, wide-spreading in the open with rather slender branches.

Leaves—Alternate, ovate to oblong and obovate, 5—6 inches long, 3—4 inches wide, acute at the apex, rounded, cuneate or truncate at the base, generally 7-lobed, the lobes repand-dentate and bristle-tipped and separated by deep, wide, rounded sinuses which extend half way to the midrib or beyond. At maturity the leaves are thick, firm, glabrous, dark green and very lustrous above, paler and more or less pubescent beneath, or glabrous except for tufts of rusty hairs in the axils of the principal veins. Petioles stout, 2—6 inches long.

Flowers—Appearing in May and early June when the leaves are about one-third grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 4—6 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, reddish green, pubescent, deeply cut into 4 ovate, acute lobes; stamens 4, exserted, with yellow, apiculate anthers. Pistillate flowers in groups of 2—3 (occasionally solitary) on short tomentose peduncles, borne in the axils of the leaves of the season, each subtended by the ovate, hairy involucre scales; calyx campanulate, adnate to the ovary, the lobes acute and hirsute; pistil consisting of a 3-celled (rarely 4—5-celled) ovary surmounted by 3 ascending red styles stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs, sessile or on a short, stout peduncle, ripening the second season. Nut ovoid, light reddish brown, often striate and frequently pubescent at maturity, full-rounded and abruptly pointed at the apex, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, enclosed for about half of its length in the cup. Cup thin, turbinate or deeply cup-shaped, pale chestnut-brown and hoary without, dark reddish brown and puberulous within, the ovate, acute scales with free scarious tips toward the top.

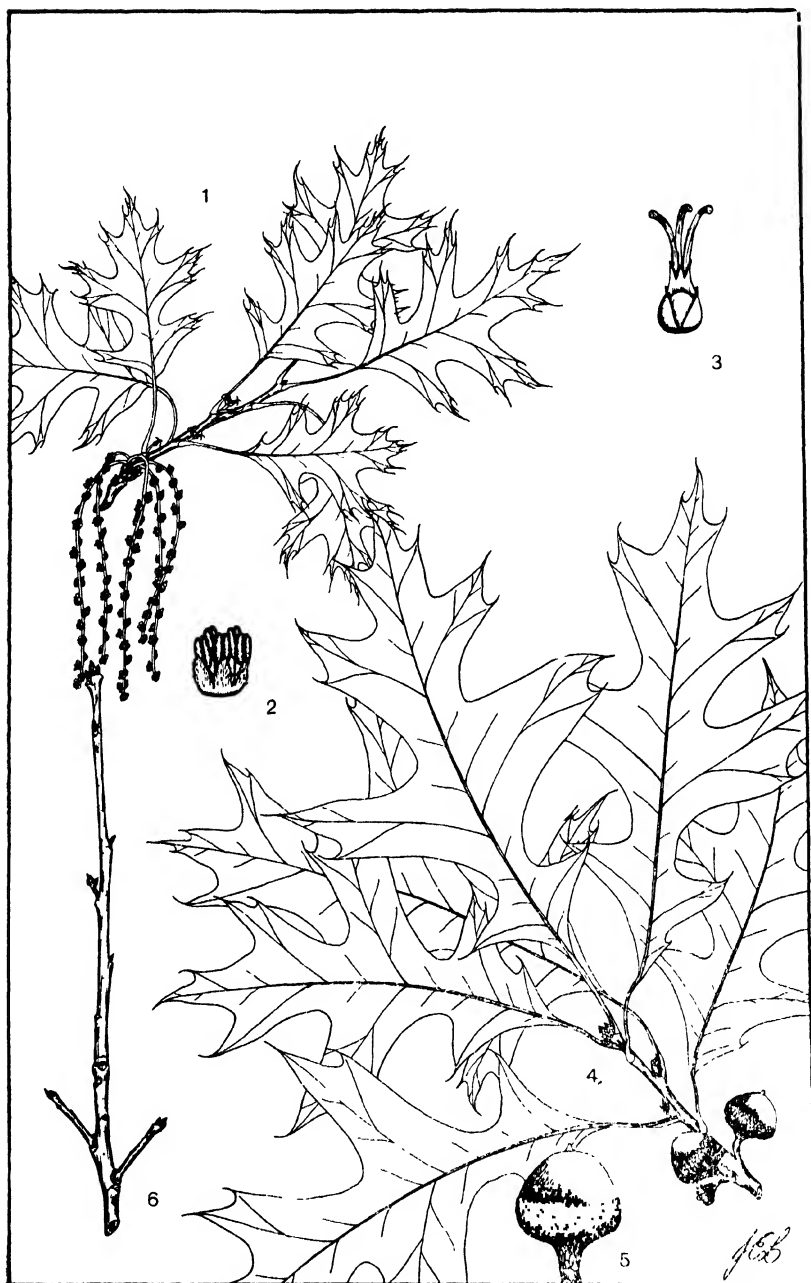
Winter characters—Twigs stout, pale-lenticellate, smooth or sparingly pubescent, dull reddish brown, at length dark brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, yellowish gray, pubescent, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. Mature bark dark brown or nearly black, thick, rough, divided by deep fissures into broad, rounded ridges which are scaly on the surface. Inner bark orange-colored.

Habitat—An upland species preferring well-drained, gravelly soils on ridges and hills. Mixed with pine on the coastal plain. Sensitive to soil conditions. Best development is attained in the lower Ohio Basin.

Range—Southern Maine through southern Ontario and southern Michigan to Iowa and southeastern Nebraska, south to western Florida and eastern Texas.

Uses—Wood hard, heavy, strong, coarse-grained, light reddish brown with paler sapwood. Mixed with that of the other Red Oaks but of an inferior quality. Largely used for fuel. A yellow dye (quercitron) may be obtained from the inner bark. The bark is also a source of tannin.

*The following hybrids are recognized within the range of this text: *Quercus velutina* X *Quercus phellos* L. = X *Quercus heterophylla* Michx.; *Quercus velutina* X *Quercus ilicifolia* Wagh. = X *Quercus rehderi* Trel.



Pin Oak, Swamp Spanish Oak

Quercus palustris Muench.

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{1}{5}$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

FAGACEAE

Quercus palustris Muench.*

Pin Oak,** Swamp Spanish Oak

Habit—At maturity usually a medium-sized tree 70–80 feet in height with a trunk diameter of 2–3 feet, under optimum conditions occasionally 120 feet tall. Crown in young trees pyramidal and symmetrical, at length broader and open, the lower branches pendulous and shorter than those above. Twigs slender, with a tendency to be upright along the branches, hence probably the common name, Pin Oak. Bole straight, clean, continuous into the crown.

Leaves—Alternate, broadly oval to obovate, 4–6 inches long, 2–4 inches wide, acute at the apex, usually cuneate at the base, 5–7-lobed, the lobes dentate and bristle-tipped and separated by wide, rounded sinuses which extend more than half way to the midrib. At maturity the leaves are thin, firm, dark green and lustrous above, and paler, lustrous, and glabrous except for tufts of axillary hairs below. Petioles slender, $\frac{1}{2}$ –2 inches long.

Flowers—Appearing in May in the North when the leaves are about one-third grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2–3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx broadly campanulate, yellowish green, puberulous, deeply cut into 4–5 oblong, rounded, slightly sinuate lobes; stamens 4–5, the yellow anthers slightly emarginate and glabrous. Pistillate flowers in groups of 2–3 (occasionally solitary), borne on short, tomentose peduncles from the axils of the leaves of the season, each subtended by the broadly ovate, tomentose involucre scales; calyx adnate to the ovary, the lobes acuminate; pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 elongated, spreading, strap-shaped red styles stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs, sessile or short-stalked, ripening the second season. Nut nearly hemispherical, light brown and often striate, rounded and abruptly pointed at the apex, about $\frac{1}{2}$ of an inch long, enclosed for about two-fifths of its length in the cup. Cup thin, shallow, saucer-shaped, pale reddish brown without, with thin, closely appressed scales, dark reddish brown and puberulous within.

Winter characters—Twigs slender, tending to be upright along the branches, tough, pale-lenticellate, lustrous, dark reddish or grayish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, light chestnut-brown, about $\frac{1}{8}$ of an inch long. Mature bark light grayish brown, quite smooth, with low scaly ridges and shallow fissures.

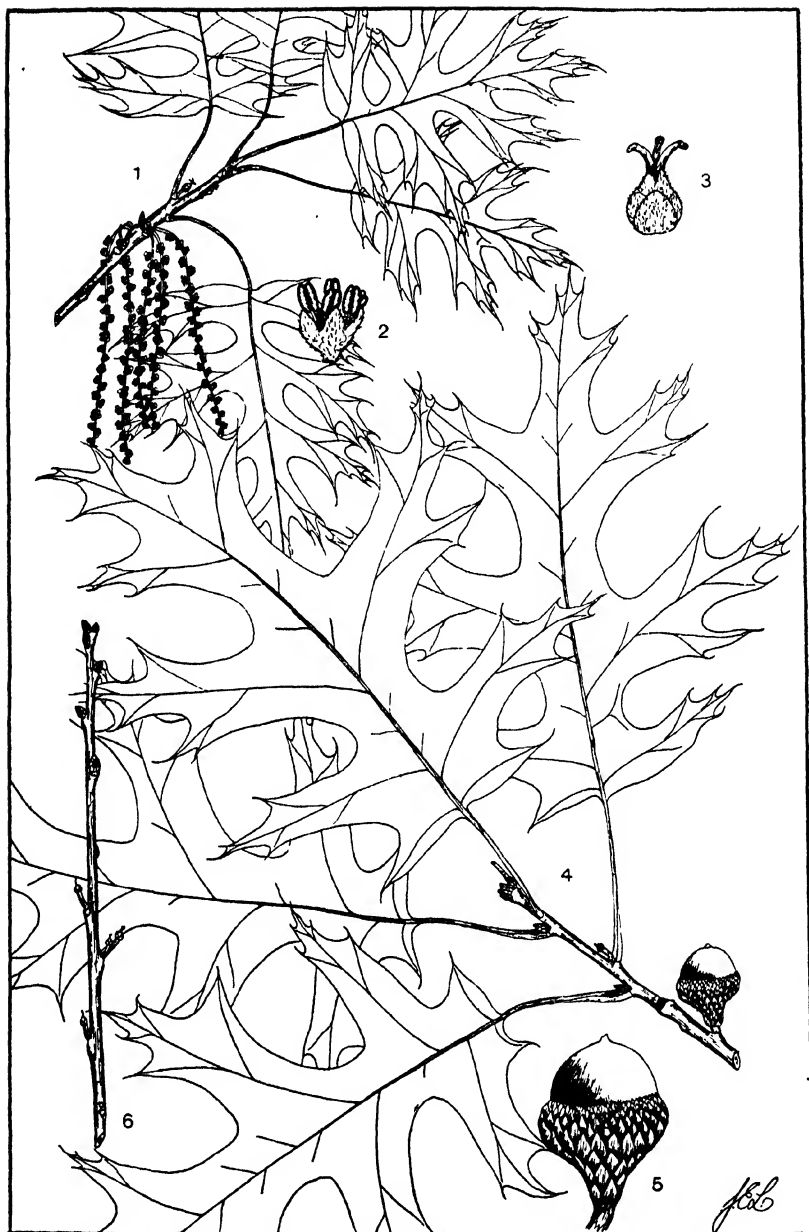
Habitat—A bottomland species, preferring deep, rich, moist, soils, more rarely on moist upland sites. Generally associated with other bottomland trees.

Range—Central New England through north-central Pennsylvania, extreme western New York, southern Ontario and s. Michigan to eastern Iowa, south to Oklahoma, Tennessee, and Virginia. Most abundant and of largest size in the lower Ohio Basin.

Uses—Considerable lumber is obtained from this species. Wood hard, heavy, strong, close-grained, pale brown with lighter sapwood. Not distinguished in the trade from that of the other Red Oaks, but usually knotty because the tree does not self-prune well. Planted extensively for shade and ornament because of its symmetrical form, beautiful foliage, rapidity of growth, and the ease with which it may be transplanted.

*For hybrid between Pin and Red Oak, see under *Quercus borealis* var. *maxima* Sarg.; *Quercus palustris* X *Quercus phellos* L. = X *Quercus schochiana* Dieck.

**Hill or Jack Oak, *Quercus ellipsoidalis* E. J. Hill, is closely allied to this species. It differs from Pin Oak in the shape of the acorn, hence the name "ellipsoidalis." Hill Oak ranges from northwestern Ohio and central Michigan westward to southeastern Minnesota and eastern Iowa. For character to separate Hill Oak from Scarlet Oak, see second foot note, page 227.



Scarlet Oak

Quercus coccinea Muench.

1. A twig showing pistillate and staminate flowers, and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{5}{8}$
3. A pistillate flower, lateral view $\times 5$
4. A twig showing mature leaves and fruit $\times \frac{1}{2}$
5. Nut with cup, lateral view $\times 1$
6. Winter twig with immature acorns $\times \frac{1}{2}$

FAGACEAE

Quercus coccinea Muench.*

Scarlet Oak

Habit—Generally a medium-sized tree 60—80 feet in height with a trunk diameter of 2—3 feet, under optimum conditions sometimes 100 feet in height and 4 feet through at the butt. Crown in the open narrow, irregular, rounded or oblong, with wide-spreading basal branches, in dense stands greatly reduced.

Leaves—Alternate, oblong-obovate to elliptic, 3—6 inches long, $2\frac{1}{2}$ —4 inches wide, acute at the apex, truncate or cuneate at the base, 7- or rarely 9-lobed, the lobes repand-dentate and bristle-tipped at the apex and separated by deep, wide, rounded sinuses which extend over half way to the midrib. At maturity the leaves are thin, firm, glabrous, lustrous and dark green above, paler and sometimes with tufts of rusty pubescence in the axils of the veins below. Petioles slender, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long. The foliage turns dark red to bright scarlet in the autumn, hence the common name.

Flowers—Appearing in May or early June when the leaves are about half grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3—4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud; calyx campanulate, greenish red, pubescent, cut into 4—5 ovate, acute lobes; stamens 4—5, with glabrous, pale yellow anthers. Pistillate flowers in groups of 2—3 (or solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy, involucre scales; calyx campanulate, shallowly lobed; pistil consisting of a 3-celled (rarely 4—5-celled) ovary surmounted by 3 elongated, spreading, strap-shaped, red styles stigmatic on the inner surface.

Fruit—An acorn, borne solitary or in pairs, sessile or short-pedunculate, ripening the second season. Nut ovoid, light reddish brown and often striate, rounded and abruptly pointed at the apex, $\frac{1}{2}$ —1 inch long, enclosed for one-third to one-half of its length in the cup. Cup turbinate or cup-shaped, thin, reddish brown with closely appressed, slightly puberulous scales without edged with a reddish border,** light reddish brown within.

Winter characters—Twigs slender, pale-lenticellate, smooth, lustrous, light reddish brown, at length dark brown. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, acute, dark reddish brown, somewhat pubescent. Mature bark dark brown, thin, divided by shallow furrows into irregular ridges, scaly at the surface; inner bark reddish.

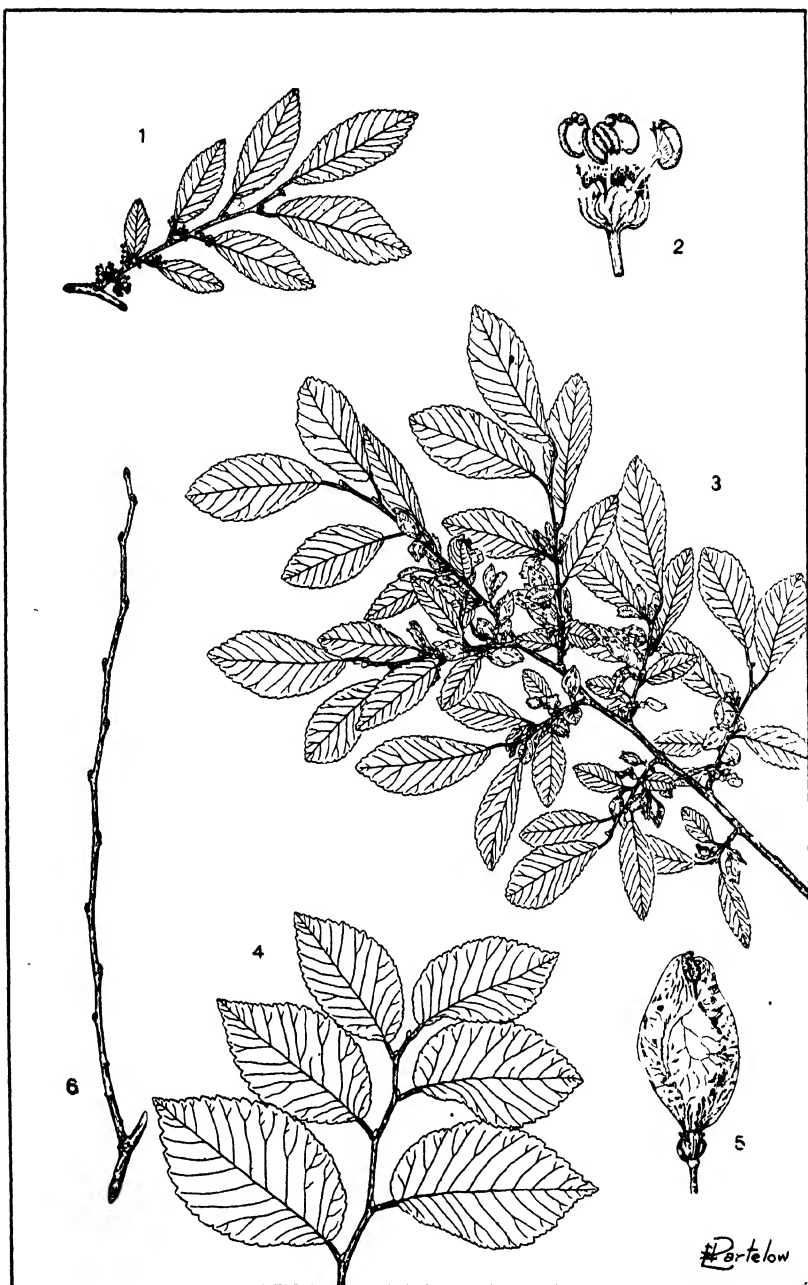
Habitat—Prefers light sandy or gravelly soils in company with other oaks, hickories, etc. Often forms a considerable part of the oak forests east of the Appalachians.

Range—Southern Maine through central New York, southern Ontario, central Michigan and southern Wisconsin to western Iowa, south to Maryland, in the mountains to Georgia, and to eastern Oklahoma.

Uses—The wood of this species is inferior to that of *Quercus borealis* var. *maxima* but is put to the same uses. The tree is desirable ornamentally because of its fast growth and beautiful foliage which turns scarlet in the autumn, but is subject to early decay resulting in wind-break.

*The following hybrids may be encountered in the Northeast: *Quercus coccinea* X *Quercus borealis* var. *maxima* Sarg.—X *Quercus benderi* Baen.; *Quercus coccinea* X *Quercus ilicifolia* Wagh.—X *Quercus robbinsii* Trel.

**This character will serve to separate this species from Jack or Hill Oak, *Quercus ellipsoidalis* E. J. Hill in which the scales are of uniform color (see foot note under Pin Oak, page 225).



Chinese Elm

- Ulmus parvifolia* Jacq. [*Ulmus chinensis* Pers.]
- | | |
|--|---|
| 1. A branch showing mature leaves and flowers $\times \frac{1}{2}$ | 4. A vigorous, non-fruiting branch showing mature leaves $\times \frac{1}{2}$ |
| 2. A flower, lateral view $\times 4$ | 5. Samara, lateral view $\times 2$ |
| 3. A branch showing mature leaves and fruit $\times \frac{1}{2}$ | 6. Winter twig $\times \frac{1}{2}$ |

ULMACEAE

Ulmus parvifolia Jacq. [*Ulmus chinensis* Pers.]

Chinese Elm

Habit—Generally a small tree 15—30 feet tall with a short trunk 6—12 inches in diameter and a globose or oblong, bushy crown composed of long, wide-spreading, drooping branches and fine branchlets, under optimum conditions occasionally attaining a height of 50—75, at other times shrubby.

Leaves—Alternate, ovate to obovate and oblong, $\frac{3}{4}$ —2½ inches long, $\frac{3}{8}$ —1½ inches wide, acute or obtusish at the apex, rounded and somewhat unequal or scarcely unequal at the base, simply- or nearly simply-serrate, at maturity subcoriaceous, glossy green and glabrous above, at first pubescent beneath but usually glabrous by mid-summer, borne on short petioles $\frac{1}{2}$ — $\frac{1}{4}$ of an inch long. The foliage is deciduous in the Northeastern States but persists until the new leaves come out the following spring in warmer regions.

Flowers—Perfect, short-pedicellate, appearing during August and September, borne in axillary clusters of 4—5 from separate flower-buds in the axils of leaves toward the base of the growth of the season. Calyx campanulate, reddish white, quite glabrous, 4—5-lobed, the lobes short, rounded and slightly ciliate on the margins. Stamens as many as the corolla-lobes, exserted, with slender filaments and oblong, pinkish red anthers. Pistil composed of a light green, compressed, 2-celled ovary surmounted by 2 green styles which are white-papillate and stigmatic along their inner surface.

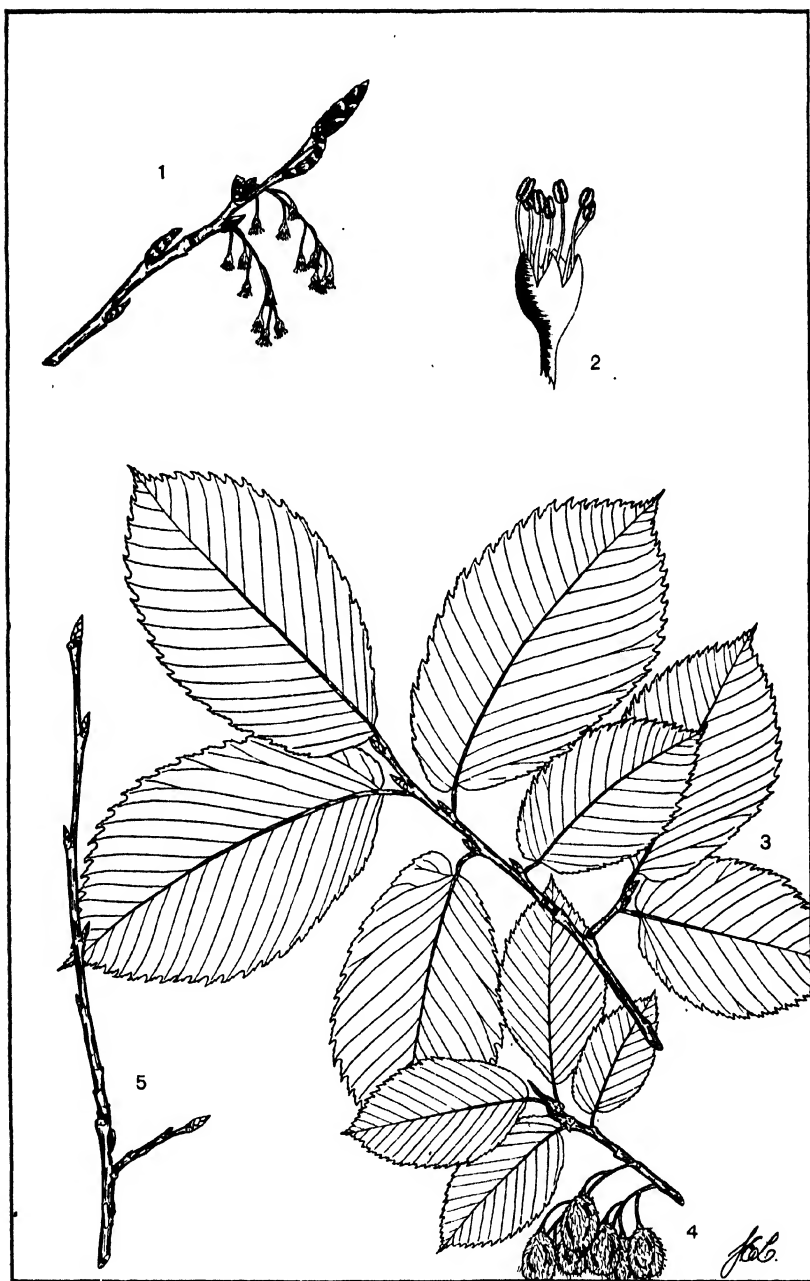
Fruit—A short-stalked, elliptic-ovate, pale green, 1-seeded samara, about $\frac{1}{3}$ ths of an inch long, marked by a horizontal line indicating the union of the 2 carpels, smooth throughout, ripening in the autumn before the leaves fall. Wing broad, notched at the apex, rounded or somewhat wedge-shaped at the base, naked on the margin, obscurely reticulate-veined. Seed central.

Winter characters—Twigs numerous, slender, with inconspicuous, pale brown lenticels, pubescent or slightly puberulous, olive- or reddish brown turning brownish gray or gray the second season. Terminal bud absent. Leaf-buds borne toward the top of the growth of the season, ovate, acute, chestnut-brown, about $\frac{3}{32}$ ths of an inch long. Flower buds absent (since the tree blossoms in the autumn), the leaf-scars toward the base of the season's growth frequently with the persisting inflorescence-stalks of the previous autumn in their axils. Mature bark gray, somewhat scaly, on old trees peeling off in roundish flakes exposing the brown inner bark beneath.

Habitat—Not exacting in its soil requirements and apparently thriving on various types of sites. A moisture-loving species like the other elms, preferring deep, rich, well-drained soils.

Range—China, Corea, and Japan. Introduced into this country as an ornamental for its form and handsome foliage which turns bright yellow in the autumn. Now naturalized about Albany, N. Y., and other Hudson Valley sections and apparently spreading.

Uses—Important only as an ornamental at the present time.



Rock Elm, Cork Elm

Ulmus thomasi Sarg. [*Ulmus racemosa* Thomas, not Borkh.]

- | | |
|---|---|
| 1. A twig showing flowers and leaf-buds x $\frac{1}{2}$ | 4. A twig showing fruit and immature leaves x $\frac{1}{2}$ |
| 2. A flower, lateral view x 4 | 5. Winter twig x $\frac{1}{2}$ |
| 3. A twig showing mature leaves x $\frac{1}{2}$ | |

ULMACEAE

Ulmus thomasi Sarg. [*Ulmus racemosa* Thomas, not Borkh.]

Rock Elm, Cork Elm

Habit—Usually a tree 50–70 feet in height with a trunk diameter of 1–2 feet, occasionally under optimum conditions 100 feet tall with a trunk 3–4 feet through at the butt. In the open the crown is narrow-oblong and round-topped, consisting of numerous, short, slender branches, those near the base drooping and extending to within 6–8 feet of the ground. The bole continues into the crown but, under forest conditions, may be free of branches for 40–60 feet. An intolerant species.

Leaves—Alternate, oblong-oval to obovate, 2–2½ inches long, ¾–1 inch wide, abruptly acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity thick, firm, smooth, dark green and somewhat lustrous above with prominent midrib and secondary veins, pale-pubescent beneath, borne on pubescent petioles about ¼ of an inch long.

Flowers—Perfect, long-pedicellate, appearing before the leaves during April and early May in long-pedunculate, puberulous, 2–4-flowered, racemose cymes from separate flower-buds. Calyx campanulate, green, divided nearly to the middle into 7–8, rounded, dark red lobes. Stamens as many as the corolla-lobes, exserted, with slender, pale green filaments and purple anthers. Pistil consisting of a compressed, pale-hairy, 2-celled ovary surmounted by 2 green styles stigmatic along their inner margin.

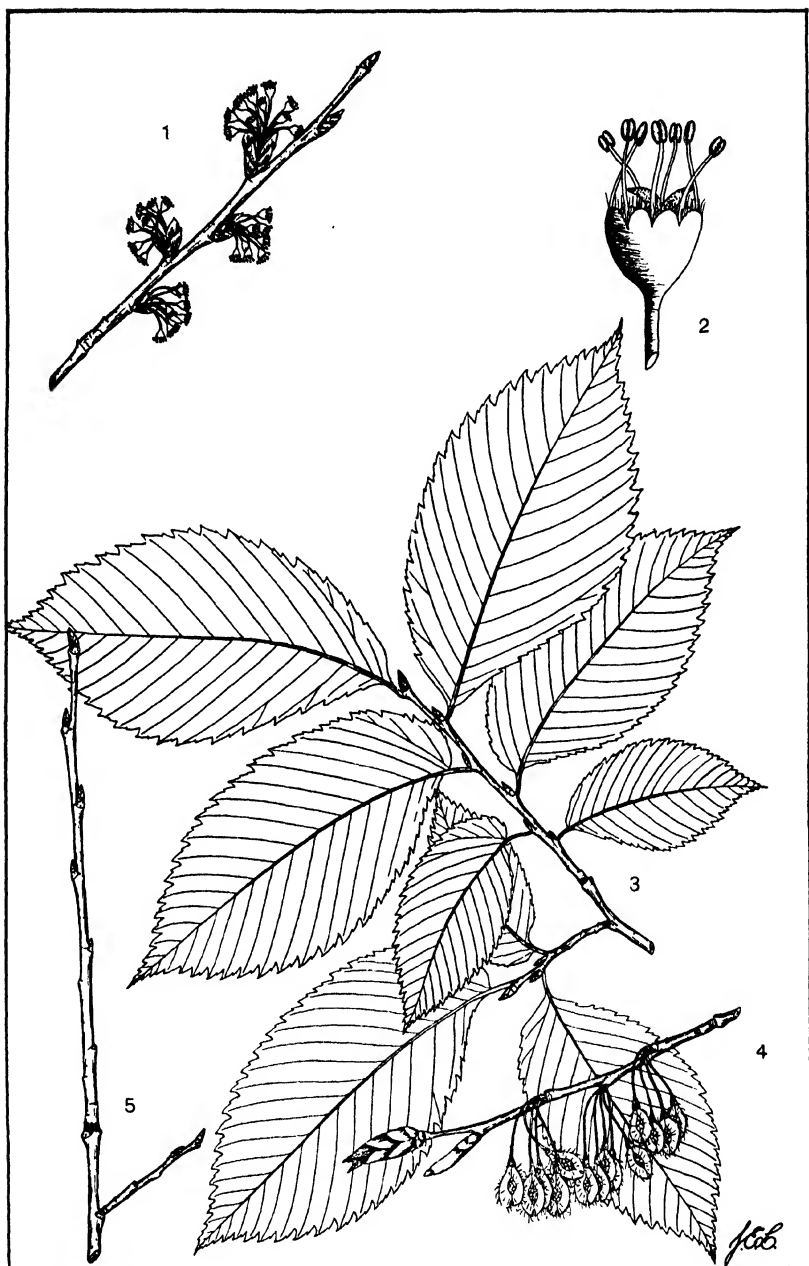
Fruit—A long-pedicellate, oval to obovate-oblong, pale green, 1-seeded samara, about ½ of an inch long, pubescent on the faces, ciliate on the margin, ripening when the leaves are about half grown. Wing broad, shallowly notched at the apex of the fruit, obscurely veined, somewhat thickened and ciliate at the border.

Winter characters—Twigs slender, lenticellate, glabrous and lustrous or puberulous, light reddish brown, at length dark brown or ashy-gray and often corky-ridged. Terminal bud absent. Leaf-buds inserted near the end of the twig, ovate, sharply acute, about ¼ of an inch long, the scales chestnut-brown with ciliate margins. Flower-buds occasionally bearing 1–2 small leaves, similar but slightly larger than the leaf-buds, borne below the leaf-buds on the twig. Mature bark thick, rough, grayish brown, divided by deep fissures into broad, flat ridges, scaly at the surface.

Habitat—Generally found on dry stony uplands, especially limestone outcrops, occasional on heavier, poorly drained clay soils. Thrives on better sites but generally excluded from these by other species because of its intolerance.

Range—Extreme southern Quebec and northern New Hampshire westward through southern Ontario, s. Michigan, central Wisconsin, and southern Minnesota to northeastern Nebraska, south to New Jersey, the mountains of central Tennessee, and eastern Kansas.

Uses—Wood hard, heavy, strong, coarse-grained, tough, difficult to split, light brown with wide, paler sapwood. Considered superior to that of the other American elms. Used for planks, bridge construction, cheese boxes, wheel-hubs, whipple-trees, agricultural implements, railroad ties, etc.



American Elm, White Elm

Ulmus americana L.

1. A twig showing flowers and leaf-buds $\times \frac{1}{2}$
2. A flower, lateral view $\times 4$
3. A twig showing mature leaves $\times \frac{1}{2}$
4. A twig showing fruit and unfolding leaf buds $\times \frac{1}{2}$
5. Winter twig $\times \frac{1}{2}$

ULMACEAE

Ulmus americana L.*

American Elm, White Elm

Habit—The largest of the elms. A tree usually 60–100 feet in height with a trunk diameter of 2–5 feet, under optimum conditions sometimes 120 feet tall with a crown spread of 50–70 feet. In the open the crown is very variable. Well known varieties are the vase-form, the umbrella-form, and the feathered form. Bole tall and straight, bearing a high crown of arching limbs and graceful, drooping branches, or short and often buttressed at the base and soon breaking up into large, ascending limbs.

Leaves—Alternate, ovate-oblong to obovate oblong, 4–6 inches long, 1–3 inches wide, acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity dark green and glabrate and slightly scabrous above, paler and soft pubescent or quite glabrous below, with prominent midrib and parallel secondary veins, borne on stout petioles about $\frac{1}{4}$ of an inch long.

Flowers—Perfect, pedicellate, appearing before the leaves during April and May in long-pedunculate, 3–4-flowered inflorescences from the axils of the inner scales of separate flower-buds, each bud giving rise to 5–8 fascicles. Calyx campanulate, reddish green, puberulous, 7–9-lobed, the lobes short, rounded and ciliate on the margins. Stamens as many as the corolla-lobes, exserted, with slender filaments and red anthers. Pistil consisting of a light green, compressed, 2-celled ovary surmounted by 2 green styles white-papillate along the inner surface.

Fruit—A long-pedicellate, elliptic to obovate-oblong, pale green, 1-seeded samara, about $\frac{1}{2}$ of an inch long, marked by a horizontal line indicating the union of the 2 carpels, smooth aside from the ciliate margin, ripening as the leaf-buds begin to unfold. Wing reticulate-venulose, ciliate on the margin, deeply notched at the apex, the teeth incurved and overlapping. Seed is produced in abundance nearly every year.

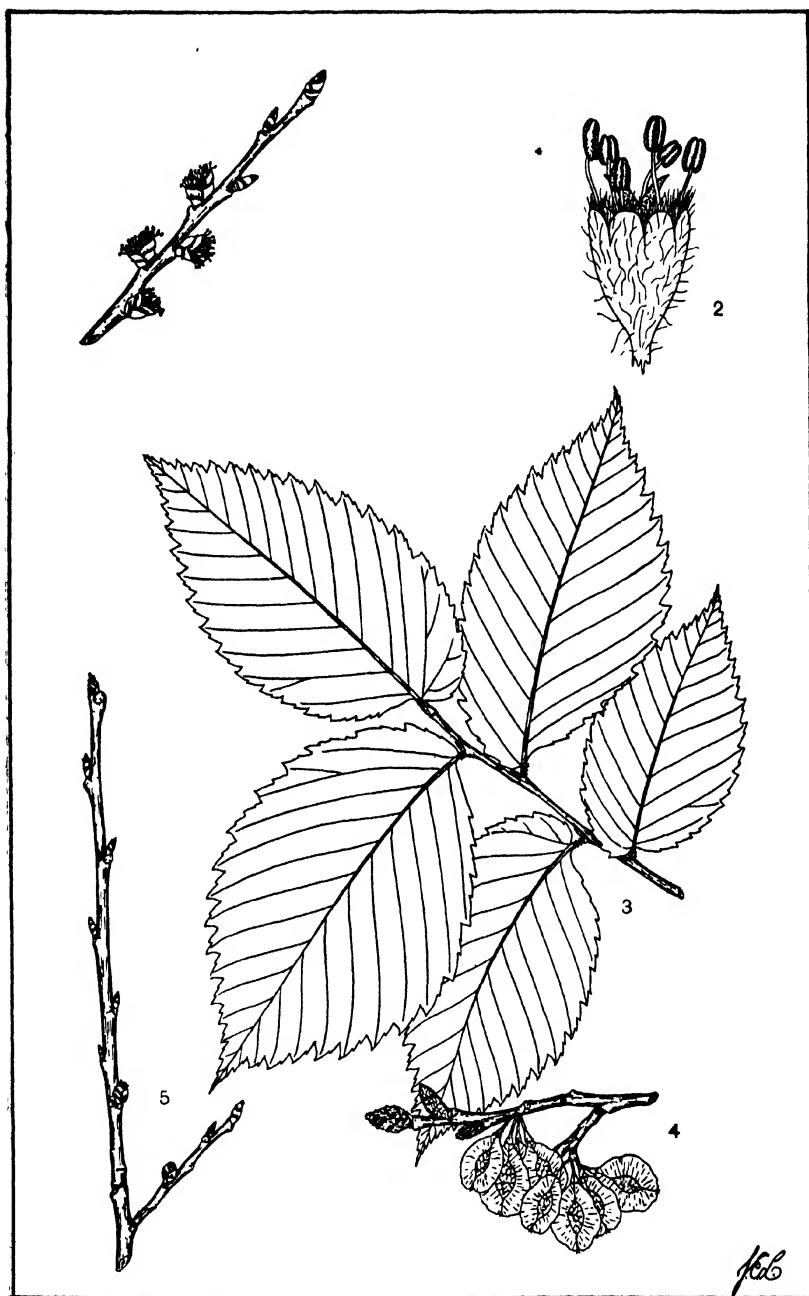
Winter characters—Twigs slender, lenticellate, glabrous or puberulous, light reddish brown, at length dark brown or ashy-gray. Terminal bud absent. Leaf-buds ovate, acute, chestnut-brown, about $\frac{1}{8}$ of an inch long. Flower-buds slightly larger, borne below the leaf-buds. Mature bark thick, rough, ashy-gray, irregularly divided by deep fissures into broad, scaly ridges. The outer bark, when cut longitudinally, shows irregular, corky, buff-colored streaks interspersed with reddish brown fibrous tissue.

Habitat—Typically a bottomland species, preferring moist, rich alluvial soils along stream courses and lakes but thriving well on upland sites. Occurs as a solitary tree and in mixture with other hardwoods.

Range—Southern Newfoundland west through southern Canada to the eastern slopes of the Rocky Mountains, south to central Florida and eastern Texas. The most widely distributed of the American elms.

Uses—A valuable species. Wood heavy, hard, strong, coarse-grained, tough, difficult to split, light brown with wide, paler sapwood. Widely used for cheese boxes, cooperage, and a variety of purposes including planking, wheel-hubs, etc. The tree with its various forms is valuable as a shade and ornamental species along avenues and highways, and is undoubtedly the best shade tree in the Northeast. It is now threatened by the Dutch Elm disease.

*Several ornamental varieties of this species are recognized by nurserymen.



Slippery Elm, Red Elm

Ulmus fulva Michx. [*Ulmus pubescens* Walt.]

- | | |
|---|--|
| 1. A twig showing flowers and leaf-buds x $\frac{1}{2}$ | 4. A twig with fruit and leaf-buds x $\frac{1}{2}$ |
| 2. A flower, lateral view x 4 | 5. Winter twig x $\frac{1}{2}$ |
| 3. A twig with mature leaves x $\frac{1}{2}$ | |

ULMACEAE

Ulmus fulva Michx. [*Ulmus pubescens* Walt.]

Slippery Elm, Red Elm

Habit—A medium-sized tree, usually 40—60 feet in height with a trunk diameter of 1—2 feet, occasionally under optimum conditions 80 feet tall. In the open bole comparatively short, soon breaking up into a number of large, spreading limbs to form a broad, open, flat-topped head, longer in forest-grown trees.

Leaves—Alternate, ovate-oblong to obovate, 5—7 inches long, 2—3 inches wide-acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity thick, firm, dark green and rough-papillose with impressed veins above, soft and smooth and coated below, especially on the midrib and in the axils of the secondary veins, with white hairs, borne on stout pubescent petioles about $\frac{1}{2}$ of an inch long.

Flowers—Perfect, short-pedicellate, appearing before the leaves during April and early May in short-pedunculate, 3-flowered inflorescences from the axils of the inner scales of separate flower-buds, each bud giving rise to a globose cluster. Calyx campanulate, green, pale-hairy, 5—9-lobed, the lobes short and rounded. Stamens as many as the corolla-lobes, exserted, with slender, pale yellow filaments and red anthers. Pistil consisting of a compressed, 2-celled ovary surmounted by 2 reddish purple, divergent styles stigmatic along their inner margin.

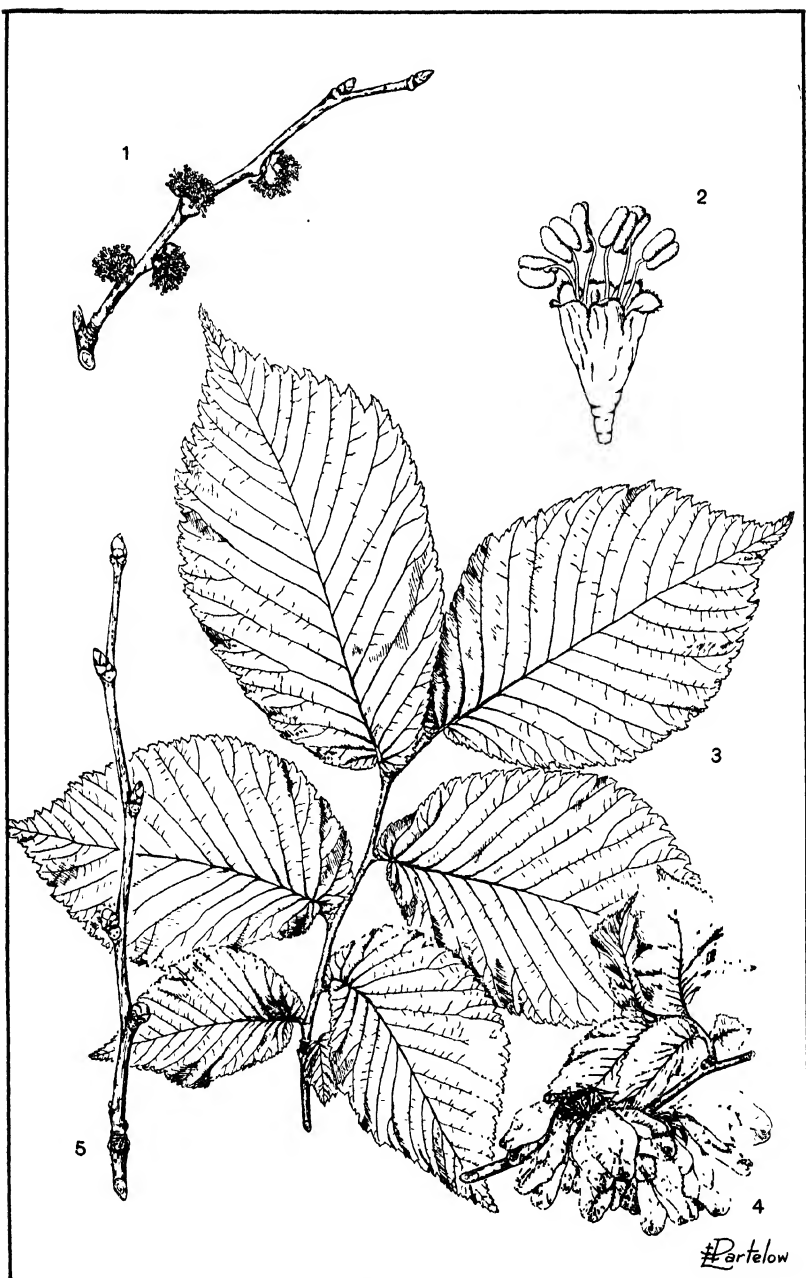
Fruit—A pedicellate, suborbicular to broadly elliptic, short-stalked, pale green, 1-seeded samara, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, marked by a horizontal line indicating the union of the 2 carpels, smooth aside for a rusty-tomentose area on the face over the seminal cavity, ripening when the leaves are about half grown. Wing broad, slightly emarginate at the apex of the fruit, rounded or somewhat wedge-shaped at the base, naked on the margin, obscurely reticulate-veined.

Winter characters—Twigs tending to be erect, stout, somewhat, scabrous, roughened by the raised lenticels and leaf-scars, pale pubescent, ashy gray to grayish brown, at length dark grayish brown. Terminal bud absent. Lateral buds with a tuft of silky rusty-brown hairs at the tip, of two sorts. Leaf-buds toward the end of twig, ovate, bluntly acute, rusty-tomentose, dark chestnut-brown, about $\frac{1}{4}$ of an inch long. Flower-buds stouter and thicker than the leaf-buds, situated farther back on the twig. Mature bark thick, rough, shallowly fissured, ashy gray to dark reddish brown. Inner bark pale white, fragrant, strongly mucilaginous.

Habitat—Stream banks and low fertile slopes, preferring deep, rich, well-drained soils but growing on poorer sites. Thrives on limestone outcrops.

Range—North bank of the lower St. Lawrence River through southern Quebec and southern Ontario to the eastern shore of Lake Superior, through north-central Minnesota to east-central North Dakota, south to western Florida and eastern Texas.

Uses—Not an important timber species. Wood hard, heavy, strong, coarse-textured, dark reddish brown with paler sapwood, durable in contact with the soil. Called Red Elm because of the red heartwood. Superior to that of American Elm but not as abundant in the trade. Used for fence posts, railroad ties, slack cooperage, wheel-hubs and agricultural implements. The mucilaginous inner bark is of value medicinally and is sometimes made into throat-lozengers.



Wych Elm

Ulmus glabra Huds. [*Ulmus scabra* Mill.; *Ulmus montana* With.;
Ulmus campestris L., in part]

1. A twig showing flowers and leaf-buds $\times \frac{1}{2}$
2. A flower, lateral view $\times 4$
3. A twig showing mature leaves $\times \frac{1}{2}$
4. A twig showing fruit and immature leaves $\times \frac{1}{2}$
5. Winter twig $\frac{1}{2}$

ULMACEAE

Ulmus glabra Huds.* [*Ulmus scabra* Mill.; *Ulmus montana* With.;
Ulmus campestris L., in part]

Wych Elm

Habit—A large tree usually 60–80 feet tall, occasionally attaining a height of 110 feet, with a stout trunk which divides into large ascending limbs to support an ample, oblong or broad, round-topped crown composed of wide-spreading branches which are often horizontal or even drooping. This species does not form root-suckers.

Leaves—Alternate, oblong-ovate to elliptic or obovate, 3–6½ inches long, 1½–4 inches wide, abruptly acuminate or sometimes 2–3-lobed at the apex, rounded and very inequilateral at the base, coarsely doubly serrate, at maturity dark green and scabrous above with impressed midrib and secondary veins, pubescent or rarely glabrous beneath, borne on very short, stout petioles ⅛–¼ of an inch long.

Flowers—Perfect, pedicellate, appearing before the leaves during April and May, in dense clusters from the axils of the inner scales of separate flower-buds, each bud giving rise to a globose cluster. Calyx turbinate, reddish green, 5–8-lobed, the lobes short, rounded, and ciliate on the margin. Stamens as many as the corolla-lobes, maturing after and at first shorter than the stigmas, at length exserted, with slender filaments and purplish red anthers. Pistil consisting of a compound, 2-celled ovary surmounted by two red, divergent styles stigmatic along their inner margin.

Fruit—A short-stalked, obovate or broadly elliptic, pale green, 1-seeded samara, ½–1 inch long, marked by a longitudinal line indicating the union of the two carpels, glabrous, ripening when the leaves are about one-third grown. Seed in the middle. Wing as wide or slightly wider than the seminal cavity, notched at the apex, reticulate-veined.

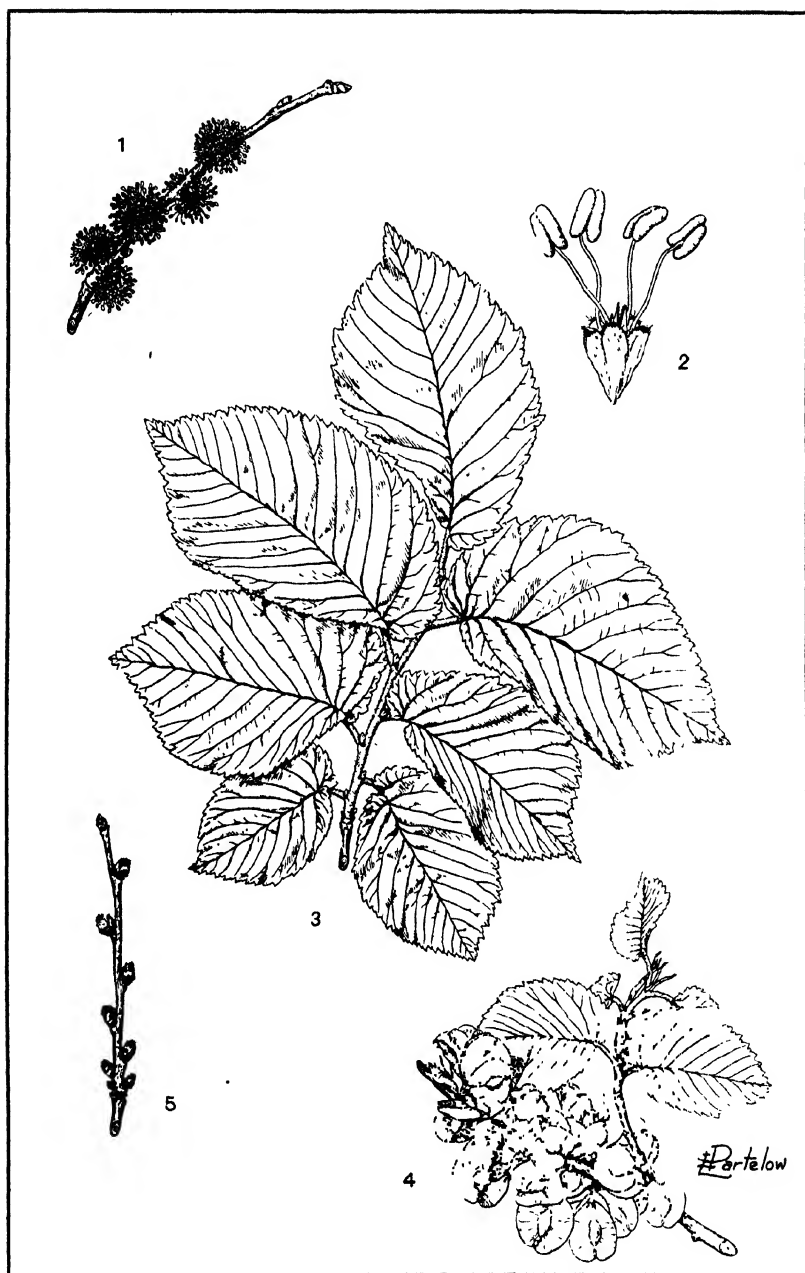
Winter characters—Twigs medium slender, lenticellate, essentially glabrous, dark olive- to dark purplish brown, at length olive- or blackish gray. Terminal bud absent. Lateral buds usually projecting to one side of the leaf-scar. Leaf-buds ovate, acute, purplish brown to purplish black, glabrous or some of the upper bud-scales sparingly pubescent on the margin and back, about ¼ of an inch long. Flower-buds broader than the leaf-buds (the discrepancy in size becoming more pronounced toward spring), divergent, strongly compressed, broadly oval to nearly orbicular in lateral aspect, ciliate on the margins of the bud-scales, usually borne below one or more leaf-buds and opening in advance of them. Bark blackish gray, thick, shallowly ridged but remaining comparatively smooth for many years, hence the Latin specific name, *glabra*, for this tree.

Habitat—Occasionally found as an 'escape' from improved lands around dwellings, from parks, cemeteries, etc. Not exacting as to soil requirements but thriving best on well-drained, moist sites.

Range—North and Central Europe, and western Asia. Long cultivated as an ornamental in eastern United States and now sparingly naturalized.

Uses—A desirable tree, prized for its ornamental value and with many garden forms. The wood is used commercially within the natural range of the tree.

*Many garden varieties of this species are recognized.



English Elm

Ulmus procera Salisb. [*Ulmus campestris* Mill., not L.]

- | | |
|---|---|
| 1. A twig showing flowers and leaf-buds x $\frac{1}{2}$ | 4. A twig showing fruit and immature leaves x $\frac{1}{2}$ |
| 2. A flower, lateral view x 4 | 5. Winter twig x $\frac{1}{2}$ |
| 3. A twig showing mature leaves x $\frac{3}{4}$ | |

ULMACEAE

Ulmus procera Salisb. [*Ulmus campestris* Mill., not L.]

English Elm

Habit—A large tree not uncommonly 80—100 feet in height with a trunk 2—3 feet in diameter, occasionally 125 feet tall with a trunk diameter near the base of 12 feet. The crown is comparable to that of the Wych Elm (*U. glabra* Huds.) but is somewhat narrower with more ascending branches. Also differs from Wych Elm in producing numerous suckers which arise from long, shallowly embedded, horizontal roots.

Leaves—Alternate, ovate or broad-elliptic, 2—3½ inches long, 1—3 inches wide (leaves usually smaller than those of Wych Elm), short-acuminate, very oblique at the base, doubly serrate, at maturity dark green, more or less lustrous and somewhat scabrous above, soft pubescent beneath and with axillary tufts of hairs in the vein-axils, borne on rather slender, pubescent petioles ½—¾ of an inch long.

Flowers—Perfect, short-pedicellate, appearing before the leaves during April and May in dense clusters from the inner scales of separate flower-buds, each bud giving rise to a globose cluster. Calyx turbinate, reddish green, 3—5 lobed, the lobes short, rounded, and ciliate on the margin. Stamens as many as the corolla-lobes, maturing after and at first shorter than the stigmas, at length exserted, with slender filaments and purplish red anthers. Pistil consisting of a compound, 2-celled ovary surmounted by two white, divergent styles stigmatic along the inner margin.

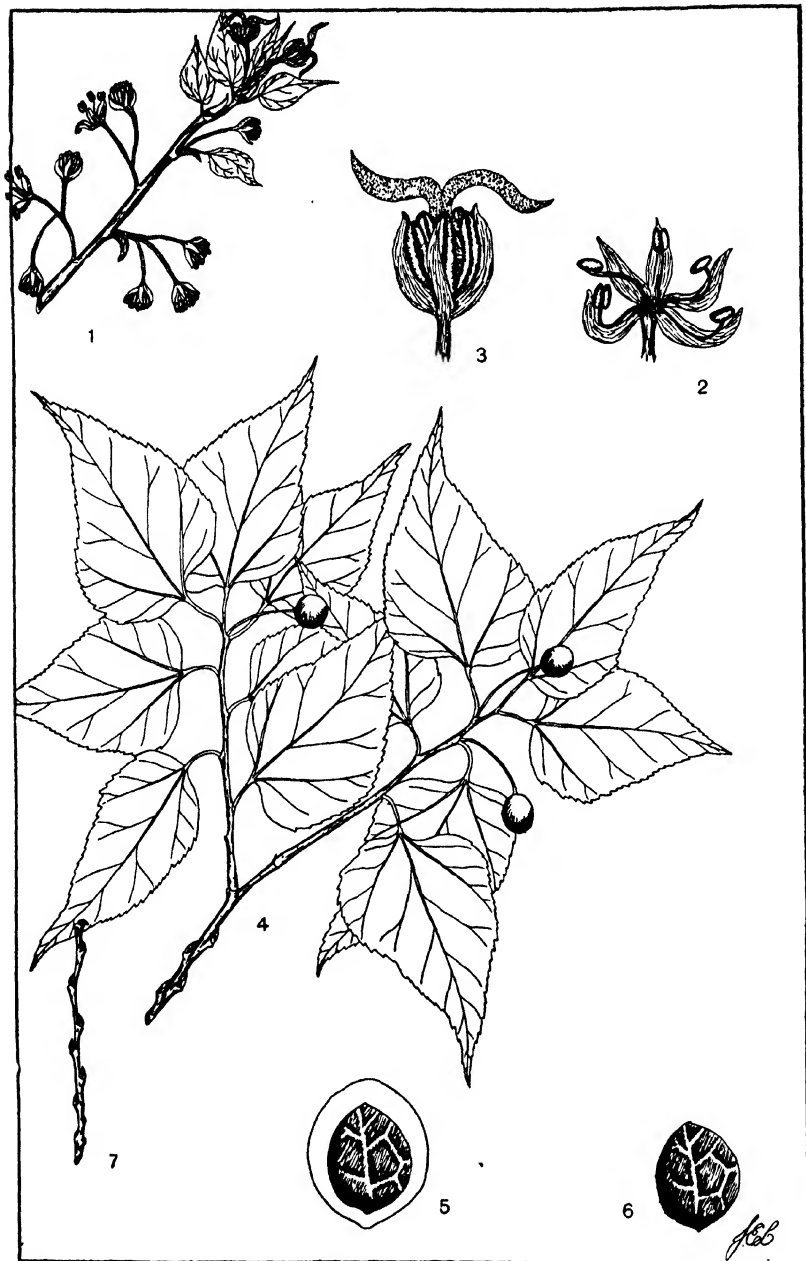
Fruit—A short-stalked, suborbicular, pale green, 1-seeded samara, about ½ of an inch in diameter, marked by a longitudinal line indicating the union of the two carpels, glabrous, ripening when the leaves are about one-third grown. Seed near the apex. Wing wider than the seminal cavity, notched at the apex, reticulate-veined.

Winter characters—Twigs medium slender, smooth or puberulous, more or less lustrous, chestnut-or reddish brown, at length olive- or blackish gray. Terminal bud absent. Lateral buds projecting to one side of the leaf-scar, darker colored than those of the Wych Elm. Leaf-buds ovate, whitish, dark smoky brown or almost black, grayish puberulous or pubescent toward the apex, about ¼ of an inch long. Flower-buds larger (the discrepancy in size becoming more marked toward spring), divergent, strongly compressed, broadly ovoid to nearly orbicular in lateral aspect, grayish pubescent toward the apex, usually borne below one or more leaf-buds. Bark gray, thick, deeply furrowed (rougher than that of Wych Elm).

Habitat—Prefers rich, moist, well-drained soils. Thrives on gravelly sites.

Range—England, and western and southern Europe. Introduced early into America and now sparingly naturalized.

Uses—An excellent ornamental species from which a number of horticultural forms have been evolved. Apparently not as common in cultivation in eastern United States as Wych Elm, *Ulmus glabra* Huds. The wood is not used commercially in this country.



Hackberry
Celtis occidentalis L.

1. A twig showing polygamous flowers and immature leaves x 1
2. An expanded staminate flower, lateral view x 3
3. A perfect flower, lateral view x 3
4. A twig showing mature leaves and fruit x $\frac{1}{2}$
5. Fruit, lateral sectional view x 2
6. Reticulate-pitted nutlet, lateral view x 2
7. Winter twig x $\frac{1}{4}$

ULMACEAE
Celtis occidentalis L.*

Hackberry

Habit—In the Northeast usually, a small tree 30—60 feet in height with a trunk diameter of $\frac{1}{2}$ —2 feet, attaining its maximum size of 130 feet in the rich alluvial soils of the Ohio Basin. In the open the trunk is short, breaking up 8—10 feet above the ground into stout spreading limbs to form a bushy, ovoid or oblong, round-topped head comparable to that of the Sugar Maple. Frequent on limestone outcrops. Sprouts from young trees are usually hardy.

Leaves—Alternate, ovate, $2\frac{1}{2}$ — $3\frac{1}{2}$ inches long, $1\frac{1}{2}$ —2 inches wide, acuminate and sometimes falcate at the apex, rounded and inequilateral at the base, sharply serrate toward the base but often entire above the middle, 3-ribbed, at maturity thin, lustrous, generally smooth and light green with sunken veins above, paler and glabrous or somewhat hairy on the prominent veins beneath, borne on slender, glabrous petioles $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long. The leaves turn yellow in the autumn.

Flowers—Appearing in May with the leaves, polygamo-monoecious, the staminate cymose from flower-buds at the base of the growth of the season, the perfect and pistillate solitary or in few-flowered fascicles from the axils of the upper leaves. Calyx pale yellowish green, divided nearly to the base into 5 linear, acute, scarious lobes. Stamens in sterile flowers inserted marginally on the white-tomentose receptacle; filaments incurved above the middle before anthesis, bearing proximal, oblong, emarginate anthers, straightening abruptly and catapulting the pollen as the flower opens. Stamens in perfect flower shorter with slightly curved filaments and anthers equal to or slightly exceeding the calyx-lobes, similar in anthesis. Pistil consisting of a sessile, green, lustrous, 1-celled, ovate ovary surmounted by a short, sessile style dividing into 2 broadly divergent lobes which are white-papillate and stigmatic on their inner surface.

Fruit—A long-stalked, subglobose or ovoid, thick-skinned, 1-seeded, orange-red to dark purple, dry drupe, about $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long, tipped by the persistent style, maturing in the autumn and persisting into the winter. Flesh thin, dry, orange-colored. Nutlet oblong-ovoid, light brown, thick-walled, apiculate, reticulate-pitted.

Winter characters—Twigs slender, somewhat zigzag, glabrous or puberulous, semi-lustrous, reddish brown, at length dark reddish brown. Pith homogeneous or chambered at the nodes. Terminal bud absent. Lateral buds ovate, acute, closely appressed and flattened, pubescent, chestnut-brown, about $\frac{1}{4}$ of an inch long. Mature bark thick, grayish brown, scaly at the surface, often roughened by characteristic, irregular, wart-like excrescences.

Habitat—Attains its best development in the deep alluvial soils of river bottoms but thrives on gravelly and stony upland sites, especially limestone outcrops. Widely scattered through the agency of birds, occurring as a solitary tree or in admixture with other hardwoods.

Range—Northern Vermont westward to eastern South Dakota, south to Virginia and Kansas.

Uses—Of no economic importance in the Northeast because of its scarcity. Wood rather soft, heavy, not strong, coarse-grained, pale yellow with wide sapwood. Frequently confused with, and mixed with, Elm. Used for cheap furniture, boxes, slack cooperage and fencing.

**Celtis occidentalis* var. *crassifolia* Gray [*Celtis crassifolia* Lam.] also occurs in the Northeast and may prove to be the more common form. It is a taller tree of more vigorous growth and darker foliage. The leaves are longer (up to 5 inches), are usually cordate at the base and more coarsely serrate, and are rougher (scabrous) on the upper surface and more pubescent on the veins beneath; the pedicels of the fruit are also pubescent. *Celtis occidentalis* var. *canina* Sarg., with narrower, oblong-ovate, long-acuminate leaves, is reported from western New York.



White Mulberry

Morus alba L.

1. A twig showing staminate inflorescences and immature leaves $\times \frac{1}{4}$
2. A staminate flower at anthesis, lateral sectional view $\times 5$
3. A twig showing pistillate inflorescences and immature leaves $\times \frac{1}{4}$
4. A pistillate flower, lateral view $\times 5$
5. A twig showing mature leaves and fruit $\times \frac{1}{2}$
6. Fleshy calyx enclosing a nutlet, lateral view $\times 3\frac{1}{2}$
7. Nutlet, lateral view $\times 10$
8. Winter twig $\times \frac{1}{2}$

MORACEAE
***Morus alba* L.**

White Mulberry

Habit—A medium-sized tree 30–50 feet in height, with a trunk diameter of 1–3 feet. Bole short, stout, often irregular, fluted and swollen at the base, branching low down into stout, ascending, wide-spreading limbs to form a low, broad, rounded crown. A very variable species with many forms and varieties.

Leaves—Alternate, ovate to ovate-oval, 2–6 inches long, 1–3 inches wide, acute or acuminate at the apex, rounded or cordate at the base, singly or doubly serrate or variously lobed, at maturity thin, firm, smooth, light green and somewhat lustrous above, paler and hairy along the prominent veins beneath, borne on slender, slightly pubescent petioles $\frac{3}{4}$ –1 $\frac{1}{4}$ inches long which exude a milky juice when broken.

Flowers—Appearing in May when the leaves are about half grown, dioecious, the staminate in cylindrical, pedunculate spikes $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long from the axils of the leaves of the season, the pistillate in oblong, pedunculate, densely-flowered spikes $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long from the upper leaf-axils. Staminate flower with deeply 4-lobed calyx, its lobes ovate, rounded, revolute toward the apex; stamens 4, inserted opposite the lobes, at first included but straightening elastically at anthesis and becoming exserted. Pistillate flower with 4-parted calyx; calyx-lobes ovate to obovate, the outer pair valvate and inclosing the others, becoming fleshy and closely investing the ovary in fruit; pistil consisting of an ovate, flattened, glabrous, pale green ovary surmounted by a short style and 2 white stigmas.

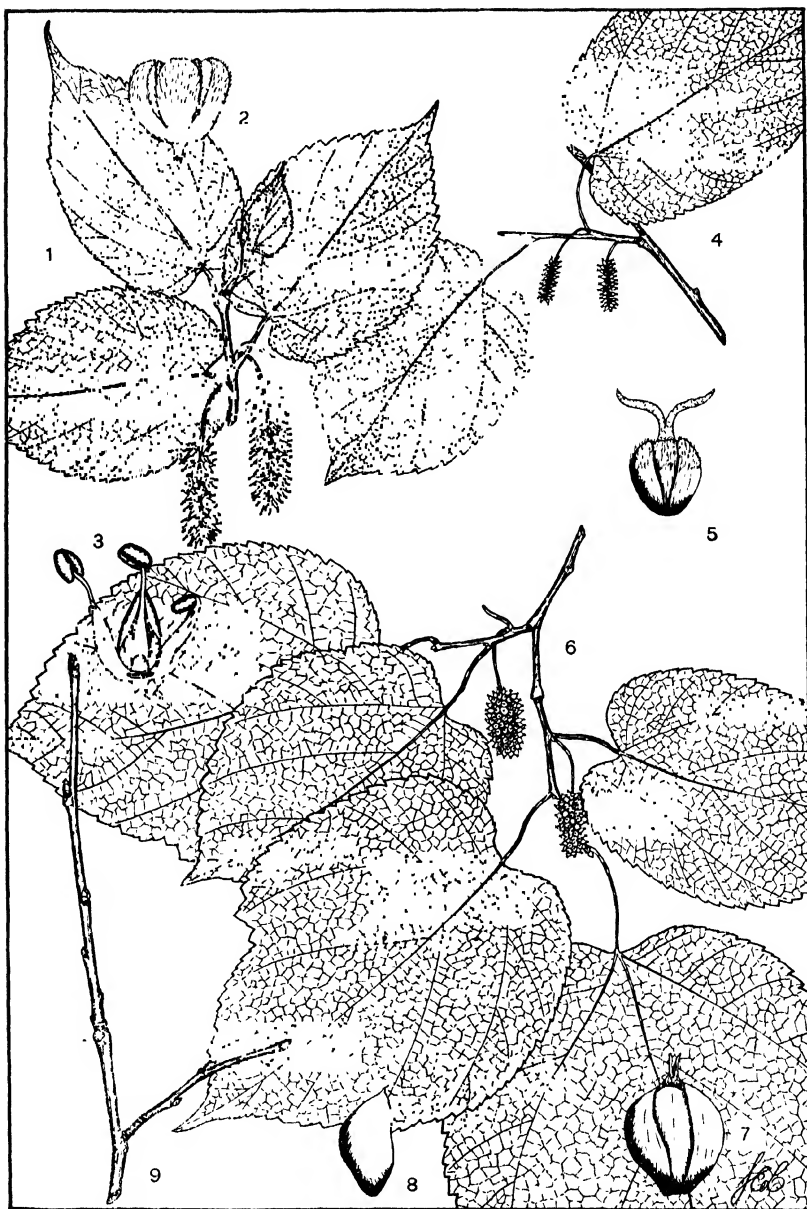
Fruit—A pedunculate, semi-fleshy, multiple, oval-oblong syncarp. $\frac{2}{3}$ – $\frac{4}{5}$ of an inch long, maturing in July or early August, composed of many small drupes, each inclosed in a fleshy calyx. At maturity the fruit is white, pinkish, or purplish violet, rather dry and sweet but insipid. Pit ovoid, pointed light brown.

Winter characters—Twigs slender, somewhat zigzag, swollen at the nodes, smooth, semi-lustrous, pale yellowish green to brownish gray, at length dark brown. Lateral twigs numerous, short, giving the crown a bushy, scraggly appearance. Terminal bud absent. Lateral buds alternate, broadly ovate, somewhat appressed and laterally inclined, chestnut-brown, about $\frac{1}{4}$ of an inch long. Mature bark thin, pale yellowish brown, broadly fissured into long, somewhat wavy, blunt ridges.

Habitat—Occurs as a 'weed' tree on waste lands along fences and on rocky hillsides. Not exacting as to soil requirements.

Range—Widely naturalized through the agency of birds in eastern North America from southern Canada southward. Originally introduced into this country in an endeavor to establish the silk industry, its leaves furnishing the favorite food of the silk worm.

Uses—Of no economic significance in the United States. Widely grown in China, Japan, India and about the Mediterranean where the silk industry flourishes. Wood rather hard and heavy, close-grained, pale yellowish brown, with thick, lighter sapwood. Durable in contact with the soil.



Red Mulberry

Morus rubra L.

1. A twig showing staminate inflorescences and immature leaves $\times \frac{1}{2}$
2. A staminate flower prior to anthesis, lateral view $\times 5$
3. A staminate flower at anthesis, lateral view $\times 5$
4. A twig showing pistillate inflorescences and immature leaf $\times \frac{1}{2}$
5. A pistillate flower, lateral view $\times 5$
6. A twig showing mature leaves and fruit $\times \frac{1}{2}$
7. Fleshy calyx enclosing a nutlet, lateral view $\times 2$
8. Nutlet, lateral view $\times 2$
9. Winter twig $\times \frac{1}{2}$

MORACEAE
***Morus rubra* L.**

Red Mulberry

Habit—A tree of medium size, usually 30–50 feet in height with a trunk diameter of 1–1½ feet, under optimum conditions in the Ohio and Mississippi valleys sometimes 70 feet tall. Trunk short, dividing near the ground into stout, ascending limbs to form a dense, broad, round-topped crown.

Leaves—Alternate, broadly ovate to ovate-oblong or suborbicular, 3–5 inches long, 2½–4 inches wide, abruptly acuminate at the apex, cordate at the base, coarsely singly or occasionally doubly serrate on the margin or mitten-shaped or 3-lobed with deep, broad, oblique, rounded sinuses, at maturity thin, membranous, veiny, dark bluish green, scabrous or nearly smooth above, soft pubescent below, borne on stout petioles ¾–1¼ inches long which exude a milky juice when broken.

Flowers—Appearing in May and early June when the leaves are about half grown, chiefly dioecious, the staminate in cylindrical, pedunculate spikes from the axils of the inner bud-scales or lower leaves, the pistillate in oblong, sometimes androgynous, pedunculate, densely-flowered spikes from the upper leaf-axils. Staminate flower with deeply 4-lobed calyx, its lobes ovate, rounded, revolute toward the apex; stamens 4, inserted opposite the calyx-lobes, at first included but straightening elastically at anthesis and becoming exserted. Pistillate flower with 4-parted calyx; calyx-lobes ovate to obovate, pubescent above, the outer pair valvate and inclosing the others, becoming fleshy and closely investing the ovary in fruit; pistil consisting of an ovate, flattened, glabrous, pale green ovary surmounted by a short style and 2 spreading, white stigmas.

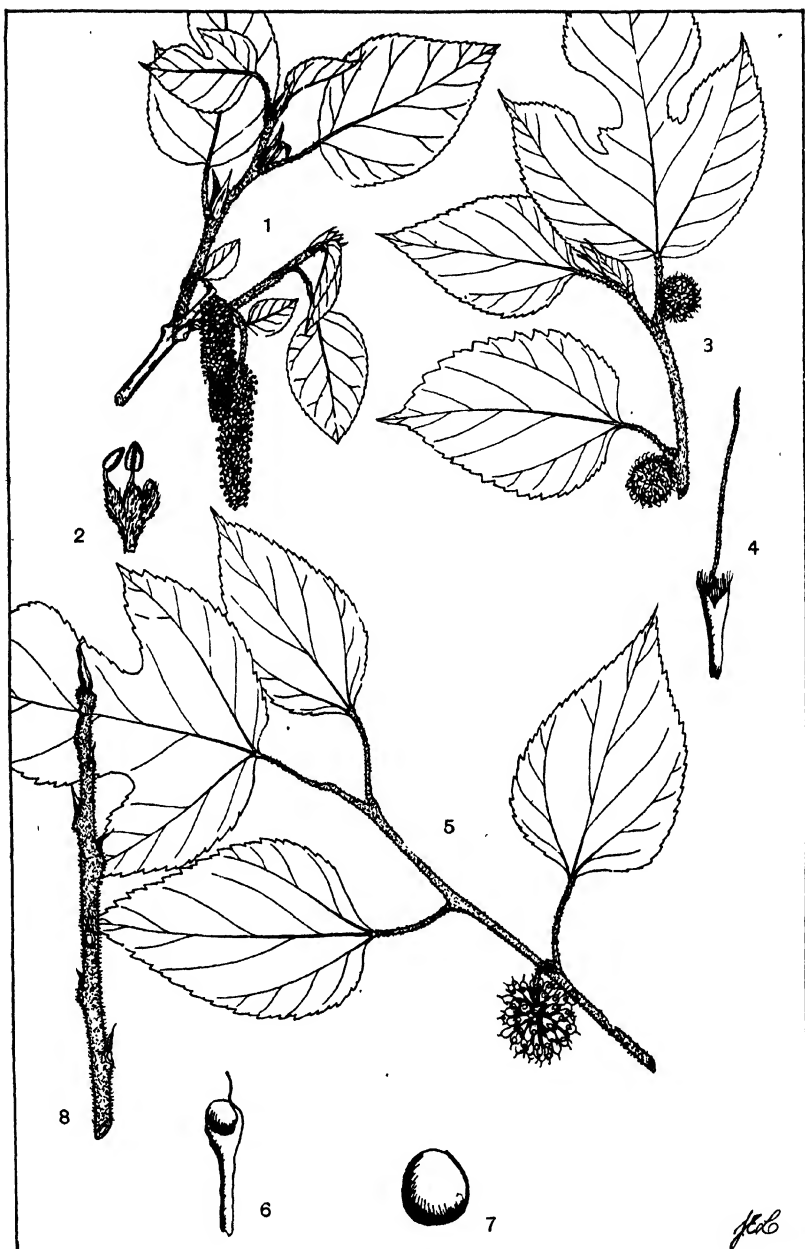
Fruit—A pedunculate, multiple, cylindrical syncarp, 1–1¼ inches long, maturing during July in the Northeast, composed of many small drupes, each enclosed in a fleshy calyx, at first greenish red, at maturity dark purple, juicy and edible. Pit ovoid, sharp-pointed, light brown.

Winter characters—Twigs slender, slightly zigzag, smooth, semi-lustrous to dull, pale reddish or orange-brown, at length dark reddish brown. Terminal bud absent. Lateral buds alternate, ovate, rounded or bluntly pointed at the apex, somewhat divergent and laterally inclined, chestnut-brown, about ¼ of an inch long. Mature bark thin, dark reddish brown, with longitudinal, flaky plates.

Habitat—Prefers deep moist soils along stream courses, in rich woods, and on fertile slopes in admixture with other species.

Range—Central and southern New England through central New York, southern Ontario, central Michigan and southeastern Minnesota to southeastern South Dakota, south to Florida and Texas.

Uses—Not an important timber species because of its medium size and scattered distribution in admixture with other species. Wood soft, light, weak, coarse-grained, durable in contact with the soil, pale-orange turning russet-brown with exposure to the light, with thick, lighter sapwood. Used for railroad ties, fence posts, loose cooperage, boat-building and small pieces of furniture.



Paper Mulberry

Broussonetia papyrifera (L.) Vent. [*Papyrius papyrifera* (L.) Kuntze.]

1. A twig showing staminate aments and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 7$
3. A twig showing heads of pistillate flowers and immature leaves $\times \frac{1}{2}$
4. A pistillate flower, lateral view $\times 7$
5. A twig showing mature leaves and fruit $\times \frac{1}{2}$
6. A druplet subtended by persisting calyx $\times 5$
7. Druplet, lateral view $\times 10$
8. Winter twig $\times \frac{1}{2}$

MORACEAE

Broussonetia papyrifera (L.) Vent. [*Papyrius papyrifera* (L.) Kuntze.]

Paper Mulberry

Habit—A small or medium-sized tree 30—50 feet in height with a trunk diameter of 1—4 feet. Bole stout, in age often oddly gnarled and convoluted. Crown wide-spreading, round-topped, consisting of many rather stout, densely hairy branches. Spreads freely by root-suckers and coppices well.

Leaves—Alternate, broadly ovate to oval, 3—8 inches long, acuminate at the apex, rounded or cordate at the base, dentate on the margin or mitten-shaped or 3-lobed with oblique sinuses which are rounded or jagged at the bottom, at maturity dark green, dull and scabrous above, paler and velvety-tomentose below, borne on pubescent, terete petioles, $1\frac{1}{2}$ —4 inches long which exude a milky juice when broken.

Flowers—Appearing in May or early June when the leaves are partly grown, inconspicuous, dioecious, the staminate in cylindrical, stalked, nodding aments, the pistillate mixed with persistent bracts in globose, pedunculate heads. Calyx of staminate flower pubescent without, deeply 4-cleft, its lobes ovate, rounded and spreading; stamens 4, exserted, inserted opposite the lobes of the calyx; rudimentary ovary present. Calyx of pistillate flower tubular, enclosing a stalked ovary which bears an exserted, laterally inserted, filiform style and terminal stigma.

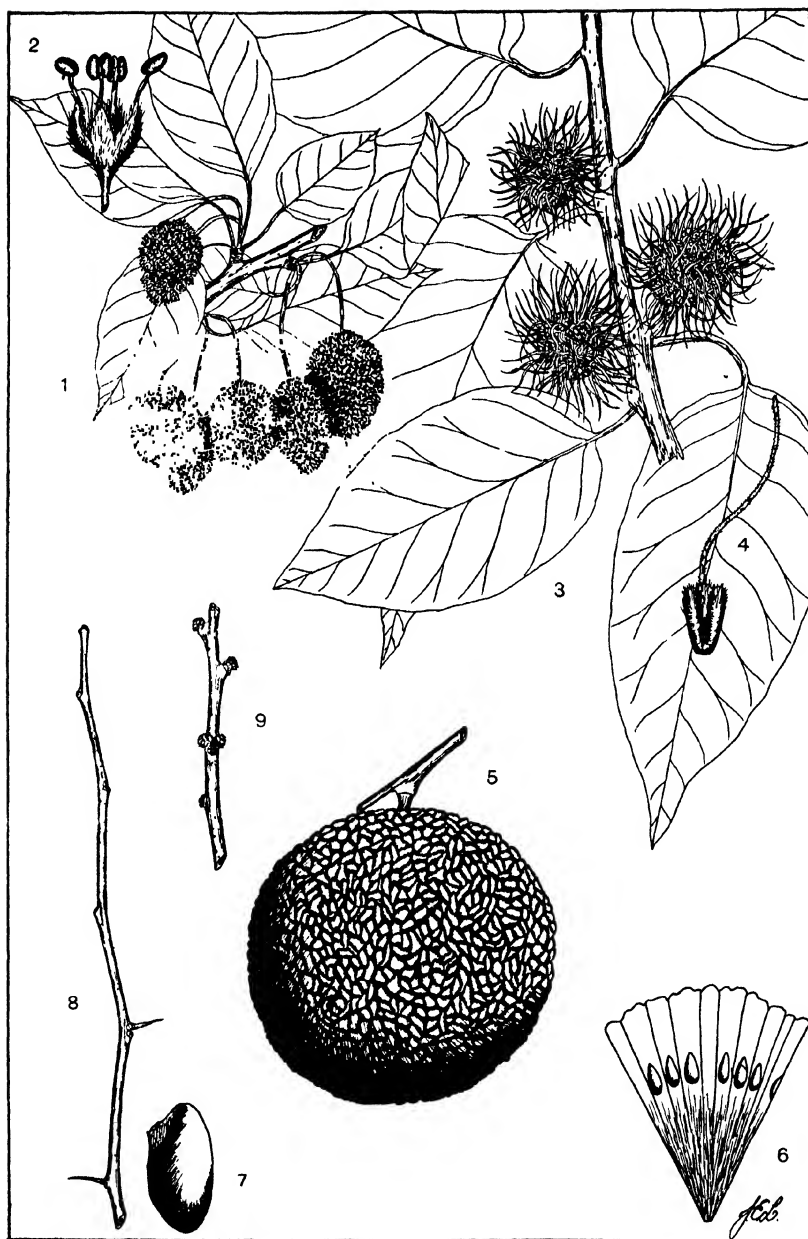
Fruit—A pedunculate, globose, orange-red syncarp, about $\frac{1}{4}$ of an inch in diameter, consisting of many small, red drupelets, each subtended by a fleshy red calyx and borne aloft on a fleshy red gynophore, the gynophores mixed with bracts and the whole forming a loose multiple. The drupelets split at maturity exposing the crustaceous, rugose, achene-like endocarp.

Winter characters—Twigs medium stout, zigzag, greenish gray, pubescent or scabrous. Terminal bud absent. Lateral buds ovate, attenuate, divergent, greenish brown, about $\frac{1}{8}$ of an inch long. Visible bud-scales 2—3. Mature bark nearly smooth, greenish gray marked by longitudinal, anastomosing, pale yellow lines, becoming gnarled and convoluted with age.

Habitat—Waste places along roadsides, in abandoned fields, and about the habitations of man.

Range—Introduced as an ornamental plant from eastern Asia and the neighboring islands. Now widely naturalized in the eastern states as far north as New York City.

Uses—The fibrous inner bark is an important source of paper-making material in China and Japan. Readily propagated by seeds or cuttings and extensively grown for ornament where the climate is not too rigorous. Wood soft, light, weak, coarse-grained, grayish white, easily worked. Of no importance in the United States.



Osage Orange

Maclura pomifera (Raf.) Schn. [*Toxylon pomiferum* Raf.;
Maclura aurantiaca Nutt.]

- | | |
|--|--|
| 1. A twig showing staminate flowers and immature leaves x $\frac{1}{4}$ | 6. Section of fruit showing seeds x $\frac{1}{2}$ |
| 2. A staminate flower, lateral view x 5 | 7. Seed, lateral view x 2 |
| 3. A twig showing pistillate flowers and immature leaves x $\frac{1}{2}$ | 8. Twig with short lateral spurs x $\frac{1}{2}$ |
| 4. A pistillate flower, lateral view x 4 | 9. Vigorous twig with lateral spines x $\frac{1}{2}$ |
| 5. Portion of a twig with fruit x $\frac{1}{2}$ | |

MORACEAE

Maclura pomifera (Raf.) Schn. [*Toxylon pomiferum* Raf.;
Maclura aurantiaca Nutt.]

Osage Orange

Habit—A tree of medium size, within its natural range sometimes 50—60 feet in height with a trunk diameter of 2—3 feet, in the Northeast usually much smaller, often a large shrub. Trunk short, dividing a few feet from the ground into stout, ascending branches, the lower arching to form an open, rather irregular, round-topped head.

Leaves—Alternate, narrowly ovate to oblong-lanceolate, 3—5 inches long, 2—3 inches wide, acuminate and apiculate at the apex, rounded or somewhat cordate at the base, entire, with arcuate secondary veins, at maturity firm, dark green and lustrous above, paler, dull and slightly pubescent on the midrib below, borne on slender pubescent petioles $1\frac{1}{2}$ —2 inches long which exude a milky juice when broken. The leaves turn bright clear yellow in the autumn before falling.

Flowers—Appearing during May and June when the leaves are about two-thirds grown, dioecious, the staminate in stout, globose, long-stalked racemes from the axils of the leaves crowded on short spurs, the pistillate sessile in short-stalked, dense, globose, many-flowered heads axillary on shoots of the year. Staminate flower slender-pedicelled; calyx campanulate, pubescent without, divided to the middle into 4 acute lobes; stamens 4, inserted opposite the calyx-lobes, becoming exerted abruptly at anthesis. Calyx of pistillate flower obovate, pubescent above, cleft to the base into 4 oblong, thick, concave lobes which are longer than the ovary and closely invest it, becoming fleshy and persisting in the fruit; pistil consisting of an ovate, sessile, flattened, glabrous, green ovary surmounted by a long filiform style covered with white stigmatic hairs.

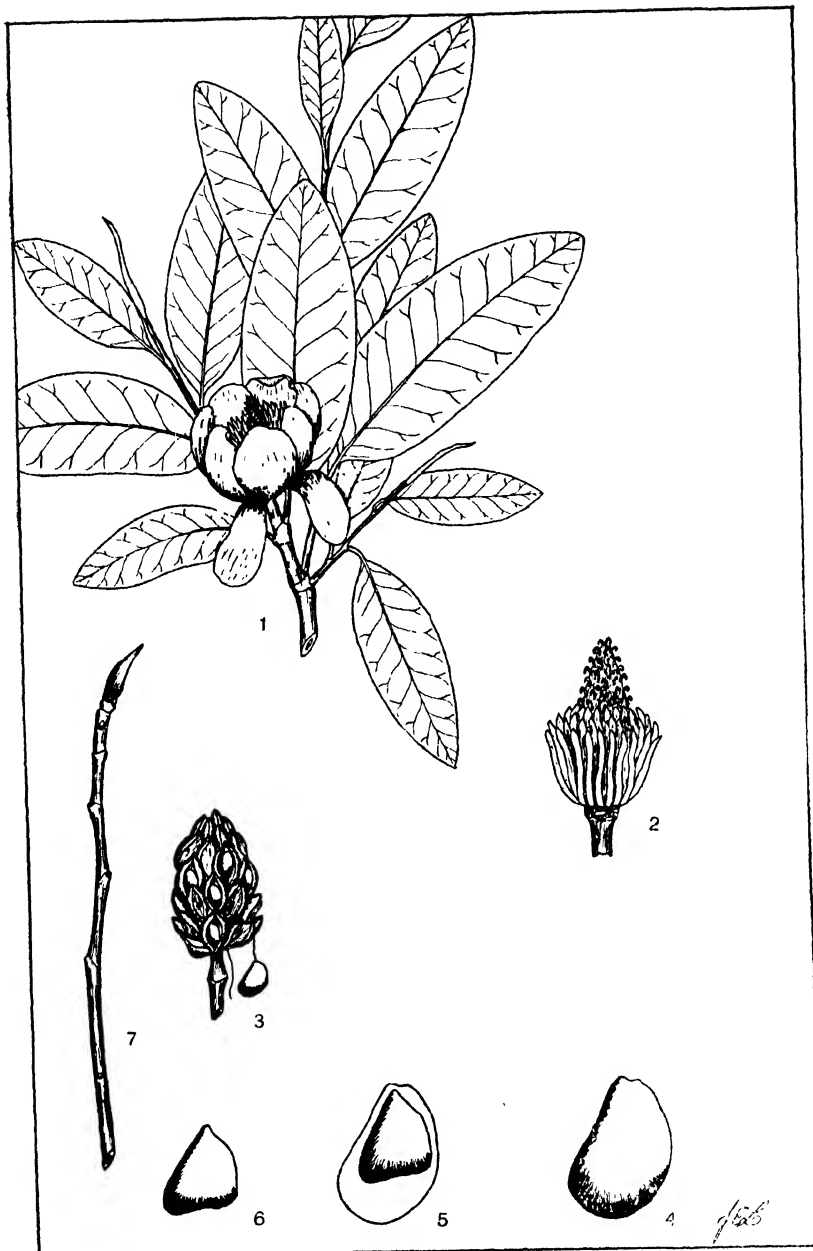
Fruit—A multiple, short-stalked, spherical, yellowish green syncarp, 4—5 inches in diameter, sculptured on the surface by the persistent, fleshy perianth-tips, enclosing in its milky pulp the oblong, compressed, pale chestnut-brown seeds. The milky juice of the fruit is bitter.

Winter characters—Twigs stout, tough, flexible, smooth, pale orange-brown, the more vigorous armed with stout, straight, axillary spines, the older twigs unarmed but bearing short, spur-like branches. Pith thick, orange-colored. Terminal bud absent. Lateral buds alternate, blunt, small, pale chestnut-brown and ciliate, partly immersed in the bark. Mature bark thick, dark orange-colored, deeply furrowed.

Habitat—In its natural range, preferring rich moist bottom-lands. Grown in the East under a variety of conditions as a hedge plant.

Range—Southern Arkansas through southeastern Oklahoma, south into central and southern Texas. Extensively planted in eastern United States as a hedge plant and frequently naturalized.

Uses—Of no commercial importance in the Northeastern States. Wood heavy, very hard and strong, coarse-grained, durable, with a striking bright orange heartwood on fresh section and thin, pale sapwood. Used for fence posts, insulator-pins, treenails, wheel-hubs, and as a source of a yellow dye. Formerly used by the Indians for bows, hence the name, Bois d'Arc. The tree makes a good hedge plant if kept trimmed.



Sweet Bay, Swamp Bay, Sweet Magnolia

***Magnolia virginiana* L. [*Magnolia glauca* L.]**

1. A twig showing a flower, and mature and immature leaves $\times \frac{1}{2}$
2. Lateral view of the flower, perianth removed $\times 1$
3. Cone-like fruit of coalescent follicles $\times \frac{1}{2}$
4. Drupaceous seed, lateral surface view $\times 1\frac{1}{2}$
5. Drupaceous seed, lateral sectional view $\times 1\frac{1}{2}$
6. Seed with outer fleshy integument removed $\times 1\frac{1}{2}$
7. Winter twig $\times \frac{1}{2}$

MAGNOLIACEAE

Magnolia virginiana L. [*Magnolia glauca* L.]

Sweet Bay, Swamp Bay, Sweet Magnolia

Habit—In the Northeast a large shrub or slender tree 20—30 feet in height with a trunk diameter of 6—9 inches, farther south under optimum conditions occasionally 50—65 feet tall. Trunk short, slender, often swollen at the base. Branches erect, at length spreading to form an oblong or rounded crown.

Leaves—Alternate, elliptic to oblong and oblong-lanceolate, 3—6 inches long, $\frac{1}{2}$ —3 inches wide, obtuse or acute at both ends, entire, at maturity thick, bright green, smooth and lustrous above, minutely pubescent and pale glaucous below, borne on slender petioles $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, falling in the North during the late autumn, semi-evergreen in the South.

Flowers—Appearing in the North over a period of several weeks in late May or early June, terminal, creamy-white, globular, perfect, fragrant, 2—3 inches across. Sepals 3, membranaceous, obtuse, spreading, deciduous. Petals 9—12, obovate, obtuse, concave, erect, deciduous. Stamens numerous, densely spiralled on the base of the torus, apiculate, with short filaments, deciduous after anthesis. Pistils densely spiralled above the stamens on the torus, each consisting of a fleshy ovary and short, recurved style stigmatic on its inner surface.

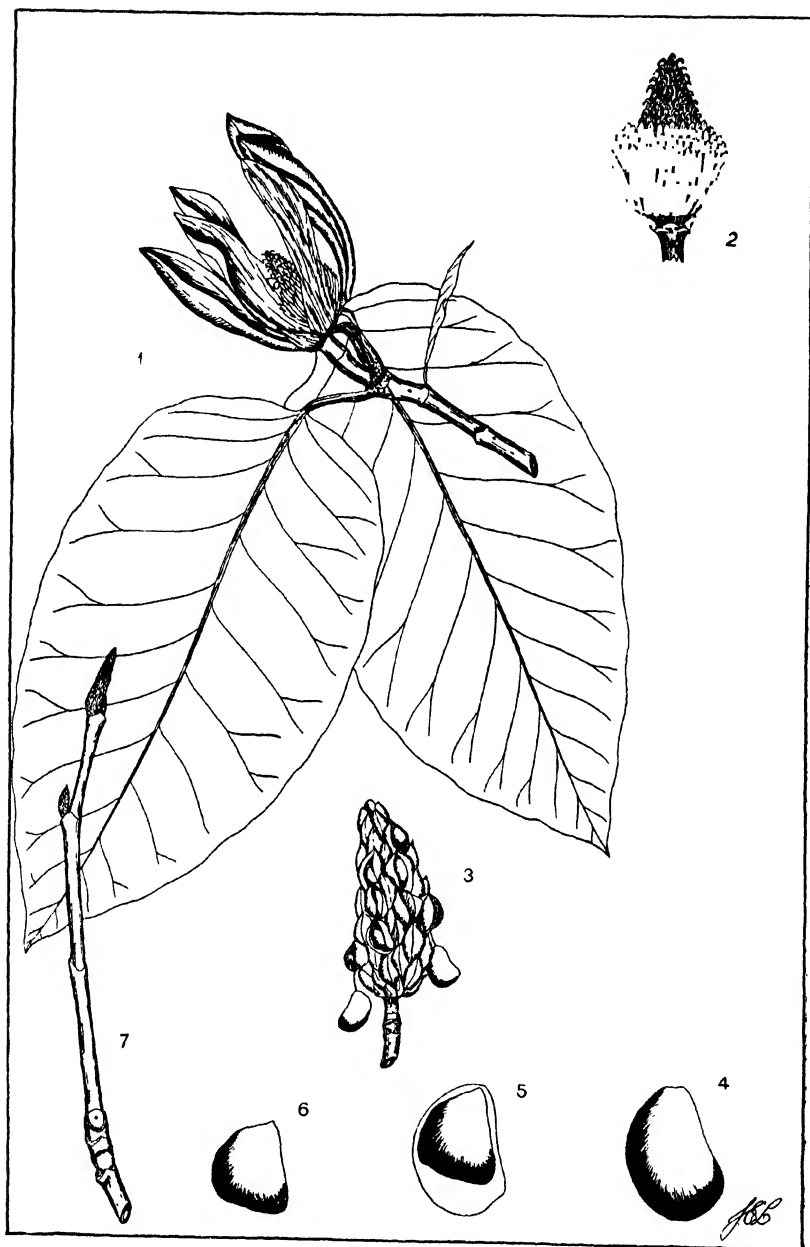
Fruit—A cone-like, fleshy to dry, ellipsoid or irregular, dark red aggregate, about 2 inches long, consisting of many cohering follicles which open at maturity along the outer suture to release the fleshy seeds. Seed red, lustrous, drupaceous without, crutaceous within, obovoid, oval, or suborbicular, compressed, about $\frac{1}{4}$ of an inch long, suspended at maturity by a long, thin, funicular cord.

Winter characters—Twigs rather slender, finely pubescent, bright green, at length reddish brown, aromatic. Pith diaphragmed-stuffed. Buds alternate, ovate-lanceolate, acuminate, bright green, pubescent, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long, covered by stipular bud-scales. Mature bark thin, light brown, smooth or covered with thin, appressed scales.

Habitat—A moisture-loving species found in shallow swamps, borders of pine-barren ponds, on moist bottomlands, and along the shores of lakes and streams.

Range—Eastern Massachusetts and Long Island, N. Y., south along the coast to Georgia, extending westward in Pennsylvania to the vicinity of Chambersburg.

Uses—Not a commercial timber species. Wood soft, light, rather coarse, pale brown tinged with red, with wide pale sapwood. Used locally in the South in the manufacture of wooden ware. The importance of the species rests largely on its value as an ornamental which is enhanced by its handsome foliage and showy, fragrant flowers.



Cucumber Tree
Magnolia acuminata L.

- | | |
|--|---|
| 1. A twig showing flower and mature leaves x $\frac{1}{2}$ | 5. Drupaceous seed, lateral sectional view x $1\frac{1}{2}$ |
| 2. Lateral view of the flower, perianth removed x 1 | 6. Seed with outer fleshy integument removed x $1\frac{1}{2}$ |
| 3. Cone-like fruit of coalescent follicles x $\frac{1}{2}$ | 7. Winter twig x $\frac{1}{2}$ |
| 4. Drupaceous seed, lateral surface view x $1\frac{1}{2}$ | |

MAGNOLIACEAE
***Magnolia acuminata* L.**

Cucumber Tree

Habit—A large, rather intolerant tree, under favorable conditions attaining a height of 80—100 feet with a trunk diameter of 3—4½ feet. In the open the bole is tapering and continuous through the pyramidal crown, the lateral limbs clothing the trunk nearly to the ground. Under forest conditions the slightly tapering trunk may be free of branches for 40—50 feet and the crown much restricted.

Leaves—Alternate, broadly elliptic to ovate or oblong-ovate, 4—10 inches long, 2—6 inches wide, short-acuminate at the apex, rounded or acute at the base, entire, at maturity thin, yellow-green, smooth and glabrous above, paler and smooth or slightly pubescent beneath, borne on slender petioles 1—1½ inches long, turning yellow in the autumn before falling.

Flowers—Appearing in the North during May and early June, terminal, glaucous-green tinged with yellow, campanulate, about 3 inches long, perfect. Sepals 3, membranaceous, acute, shorter than the petals, at length reflexed and deciduous. Petals 6, obovate-oblong, acute, concave, erect, 2½—3 inches long, deciduous. Stamens numerous, densely spiralled on the base of the torus, apiculate, with short filaments and pale yellow anthers, deciduous after anthesis. Pistils densely spiralled above the stamens on the torus, each consisting of a fleshy ovary and short, recurved style stigmatic on its inner surface.

Fruit—A cone-like, somewhat fleshy, oblong or ovoid, usually curved (through the abortion of some of the follicles), glabrous, purplish red aggregate, 2—2½ inches long, consisting of many cohering follicles which open at maturity along the outer suture to release the fleshy seeds. Seed red, lustrous, drupaceous without, crustaceous within, obovoid, compressed, about ½ of an inch long, suspended at maturity by a long, thin, funicular cord.

Winter characters—Twigs rather slender, lustrous, glabrous or sparingly pubescent, bright reddish brown, at length gray, aromatic. Pith diaphragmed-stuffed. Terminal bud ovate-oblong, acute, somewhat curved, densely covered with pale silky hairs, ⅓—½ of an inch long. Lateral buds smaller, blunt, nearly surrounded by the leaf-scar. Bud-scales stipular, valvate. Mature bark thin, dark grayish brown, separated by long furrows into scaly ridges.

Habitat—Usually found in rich woods on moist slopes and along stream courses. Prefers deep, moist, fertile soils. Occurs in mixture with other hardwoods.

Range—Central New York through southern Ontario, thence southwestward through central Indiana, southern Illinois, and central Missouri to eastern Oklahoma, south in the Appalachians to northern Georgia, n. Alabama, central Mississippi and Arkansas. Spread by the agency of birds and nowhere abundant.

Uses—A timber species of some importance. Wood light, soft, close-grained, brittle, pale yellowish brown with thin, yellowish white sapwood. Frequently not distinguished in the trade from that of the Yellow Poplar and used for similar purposes. The tree is also grown ornamentally in eastern United States and abroad.



Yellow Poplar, Tulip Tree

Liriodendron tulipifera L.

1. A twig showing a flower, and mature and immature leaves $\times \frac{1}{2}$
2. Lateral view of the flower, several petals removed $\times \frac{1}{2}$
3. Aggregate cone of samaroids, lateral view $\times \frac{1}{2}$
4. A samaroid from the cone, lateral view $\times 1$
5. Winter twig $\times \frac{1}{2}$

MAGNOLIACEAE
Liriodendron tulipifera L.*

Yellow Poplar, Tulip Tree

Habit—The tallest and perhaps the most massive tree in eastern United States. In the South commonly 100 feet in height with a straight trunk 4—6 feet through which is free of branches for 50—60 feet, under favorable conditions attaining a maximum height of 190 feet, in the Northeast usually 50—80 feet tall with a trunk diameter of 2—3 feet. In the open the crown is narrowly pyramidal or oblong, the branches extending to within 8—10 feet of the ground. Trees in the forest have flat, wide-spreading crowns borne aloft on tall, straight, naked trunks. An intolerant species, requiring full light for development.

Leaves—Alternate, broadly ovate to orbicular, 5—6 inches long and broad, truncate or broadly notched at the apex, rounded or slightly cuneate at the base, sinuately 4-lobed giving the leaf a saddle-shaped appearance, at maturity dark green, smooth and lustrous above, dull green and paler below, borne on slender, angled petioles 5—6 inches long.

Flowers—Appearing during May and June after the leaves, terminal, solitary, greenish yellow with orange markings, tulip-shaped, 2—5 inches wide, 1—1½ inches deep, perfect. Sepals 3, ovate-lanceolate, concave, greenish white, at length reflexed and early deciduous. Petals 6, oblong-obovate, rounded, erect, greenish white marked with a broad orange band at the base, deciduous. Stamens numerous, densely spiralled on the base of the torus, with filiform filaments and linear, yellow anthers, deciduous after anthesis. Pistils densely spiralled above the stamens on the elongated torus, each consisting of a 1-celled ovary surmounted by an acuminate and laterally compressed style terminating in a short recurved stigma.

Fruit—A narrow, ellipsoidal, light brown cone, 2—3 inches long, composed of many closely imbricated, indehiscent carpels (samaroids). Carpels dry, woody, consisting of a laterally compressed, 4-ribbed pericarp and large, persistent, winged style, falling during the autumn and winter from the persistent, upright cone-axis. Seed solitary by abortion, produced after the 30—60 year but with a low percentage of vitality.

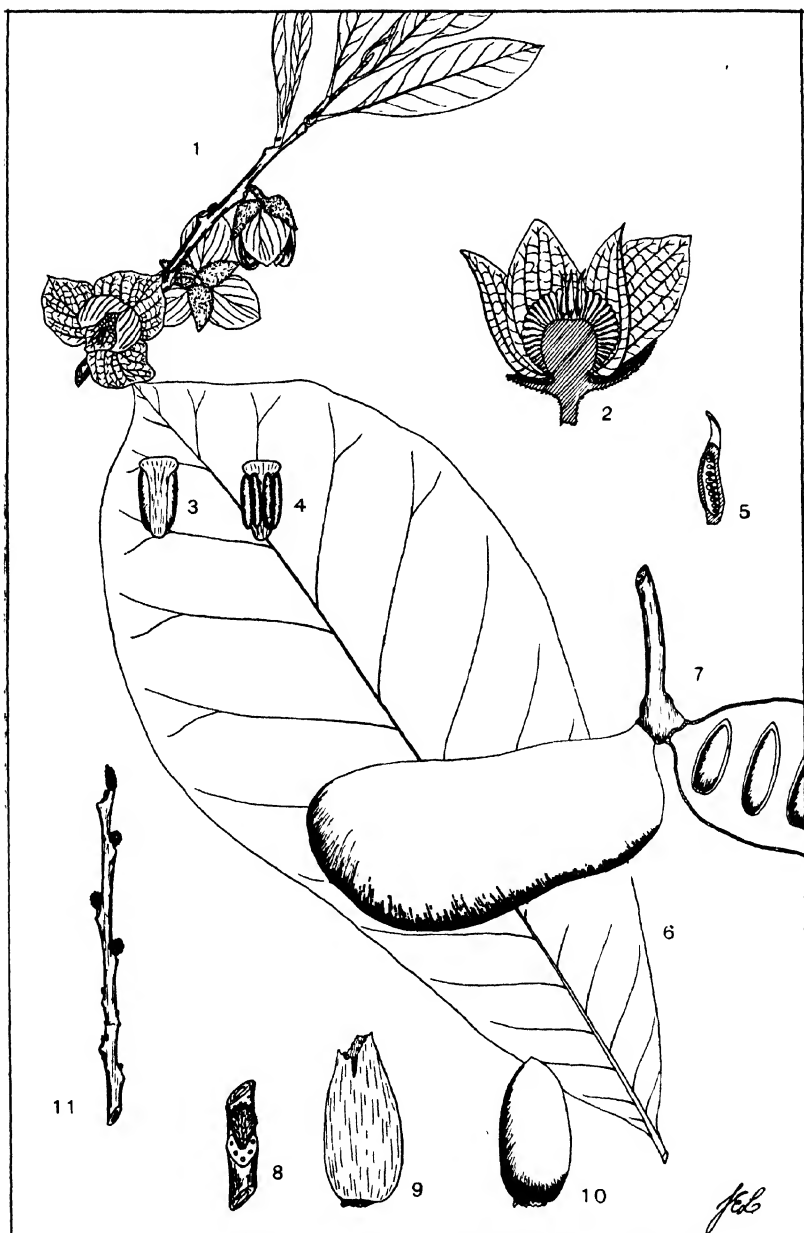
Winter characters—Twigs rather stout, smooth, lustrous, somewhat glaucous, reddish brown, at length dark gray, with an agreeable aromatic odor and bitter taste when broken. Pith diaphragmed-stuffed. Terminal bud oblong, compressed, obtuse, dark red, glaucous and white-punctate, ½—1 inch long, the scales stipular and valvate in pairs. Lateral buds similar, divergent, sometimes superposed or terminal on short spurs, ¼—½ of an inch long. Mature bark thick, brown, with long shallow furrows and rounded ridges.

Habitat—Prefers deep, rich, moist soils in admixture with other hardwoods. Occurs on bottomlands and moist mountain slopes. Attains its maximum size in the lower Ohio Basin and on mountain slopes in Tennessee and North Carolina.

Range—Rhode Island through southwestern Vermont, central New York, and extreme southern Ontario to southern Michigan, south to northern Florida and in the West to eastern Arkansas and north-eastern Louisiana.

Uses—A valuable timber species producing the yellow poplar or white-wood of commerce. Wood light, soft, brittle, weak, straight-grained, pale greenish yellow or brown with thin, nearly white sapwood. Largely manufactured into lumber and used where a soft, easily-worked wood is required. The tree is widely cultivated in the East and abroad for its ornamental value but is difficult to transplant because of its tender roots.

*A number of varieties of Tulip Tree are grown by nurserymen.



Pawpaw

Asimina triloba (L.) Dun.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A stamen, upper side $\times 5$
4. A stamen, lower side $\times 5$
5. A pistil, lateral sectional view $\times 3$
6. A mature leaf $\times \frac{1}{2}$
7. Fruit, lateral surface and sectional views $\times \frac{1}{2}$
8. Portion of twig showing lateral bud and leaf-scar $\times 1$
9. Mature seed enclosed in its aril $\times 1$
10. Mature seed $\times 1$
11. Winter twig $\times \frac{1}{2}$

ANNONACEAE
***Asimina triloba* (L.) Dun.**

Pawpaw

Habit—A shrub or small tree 20—40 feet in height with a maximum trunk diameter of 12 inches. Bole short and slender. Branches slender, spreading, forming a rather broad, high crown. This species often forms dense thickets in the shade of other trees.

Leaves—Alternate, obovate-oblong, 6—12 inches long, 2—6 inches wide, short-acuminate at the apex, tapering gradually at the base, entire, at maturity dull light green and glabrous above, paler and glabrous below, borne on a short, stout petiole $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—In our range appearing in late May and June with the leaves but usually below them on the twigs, axillary, solitary, perfect, lurid purple at maturity, $1\frac{1}{2}$ —2 inches in diameter, borne on short, stout, fulvous-brown pedicels. Sepals 3, ovate, pale green, densely pubescent on the outer surface. Petals 6, purple, reticulate-venulose, the 3 outer broadly ovate and reflexed above the middle and much longer than the sepals, the 3 inner smaller, erect, nectariferous at the base. Stamens numerous, densely spiralled on the torus. Pistils 3—15, sessile on the summit of the torus, projecting above the stamens, each consisting of a 1-celled ovary and sessile stigma.

Fruit—An oblong to ellipsoid, somewhat falcate, smooth, greenish yellow berry, becoming dark brown, pulpy and edible at maturity. Seeds dark brown, lustrous, ovoid, apiculate, compressed, about 1 inch long and half as wide, enclosed in an aril, horizontally imbedded in the fleshy pulp. The fruits are attached laterally to the torus, 1-several coming from the same flower.

Winter characters—Twigs rather slender, quite glabrous, thickened at the nodes, reddish brown and marked with narrow, shallow grooves. Buds alternate, naked, rusty-brown, tomentose. Leaf-buds slender, somewhat flattened, the lateral buds closely appressed to the twig and set in the notch of the leaf-scar. Flower-buds lateral, spherical in outline, divergent. Pith small, white. Mature bark thin, close, dark brown, slightly scaly at the surface.

Habitat—Prefers moist sites along streams in rich bottomland forests and on low, fertile slopes. Very tolerant of shade. At its optimum range often forming the bulk of the undergrowth under other species but in the Northeast usually in small isolated groups.

Range—Western New Jersey through central Pennsylvania, western New York and southern Michigan to southeastern Nebraska, south to Florida and eastern Texas.

Uses—Of no timber value because of its small size and the character of the wood. The edible fruit is sold in the regions where the tree abounds, but is not grown commercially. The species possesses some ornamental value.



Sassafras

***Sassafras officinale* Nees. et Eberm. [*Sassafras varilfolium* (Salisb.)**

Ktze.; *Sassafras sassafras* Karst.]

1. A twig showing immature leaves and staminate flowers $\times 1$
2. A staminate flower, lateral sectional view $\times 3$
3. A twig showing immature leaves and pistillate flowers $\times 1$
4. A pistillate flower, lateral sectional view $\times 3$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Drupe, lateral sectional view $\times 2$
7. Pit, lateral view $\times 2$
8. Winter twig $\times \frac{1}{2}$

LAURACEAE

Sassafras officinale Nees. et Eberm. [*Sassafras variifolium* (Salisb.) Ktze.; *Sassafras sassafras* Karst.]

Sassafras

Habit—A medium-sized tree, commonly 40—50 feet in height with a trunk diameter of 1—3 feet, generally shrubby at the northern limits of its range, in the South occasionally 100 feet tall and up to 6 feet in diameter. Trunk short, stout, soon breaking up into many stout, more or less abruptly spreading and contorted branches to form a flat-topped or rounded-oblong, bushy crown.

Leaves—Alternate, ovate or obovate, 4—6 inches long, 2—4 inches wide, entire and acute at the apex or 2—3-lobed, cuneate at the base; lobes broadly ovate and acute, with broad, rounded sinuses. At maturity the leaves are thin and bright green above, glaucescent and glabrous or pubescent below, and are borne on slender petioles $\frac{3}{4}$ —1½ inches long.

Flowers—Appearing in May with the leaves, dioecious, borne in lax, pilose, few-flowered racemes from the axils of large, obovate bud-scales. Calyx pale yellowish green, divided nearly to the base into 6 narrow, obovate lobes. Stamens 9, inserted in 3 sets on the margin of the calyx-tube, those of the inner set with orange-colored glands at the base and reduced in the staminate flowers to orange-colored staminodia. Anthers opening by 4 pores. Pistil consisting of a 1-celled, light green, glabrous ovary, a slender, curved style, and a capitate stigma.

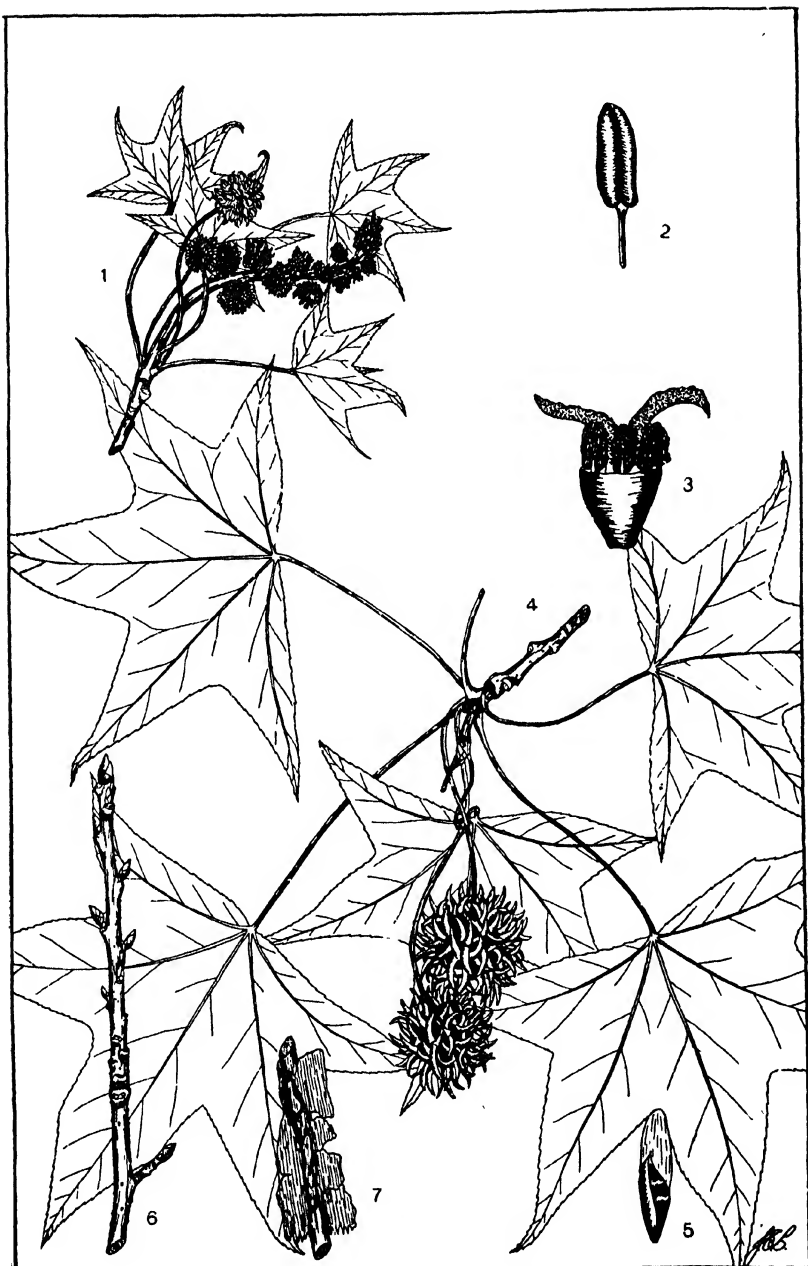
Fruit—An oblong, 1-seeded, bluish black, lustrous, bloomy drupe, about $\frac{1}{2}$ of an inch long, borne upright on a bright red, club-shaped, fleshy stem which is terminated by the fleshy, obscurely 6-lobed calyx-limb in which the fruit rests, falling soon after maturity from the persisting stalk.

Winter characters—Twigs slender, smooth and lustrous or somewhat downy, rather brittle, spicy-aromatic, light yellowish green, at length reddish brown. Vigorous shoots branching freely the first season. Inner bark mucilaginous. Pith large, white. Terminal bud ovate, acute, green, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. Lateral buds smaller and divergent. Mature bark thick, reddish brown, with deep furrows and flat-topped ridges crossed by horizontal cracks.

Habitat—Prefers a rich, sandy loam but thrives in a variety of sites along fences, in abandoned pastures, and in open, hardwood forests.

Range—Southern Maine and eastern Massachusetts through southern Vermont, southern Ontario, and central Michigan to southeastern Iowa and eastern Kansas, south to central Florida and eastern Texas.

Uses—Not an important timber species. Wood soft, brittle, coarse-grained, aromatic, dull grayish brown to orange-brown with pale yellow sapwood, very durable in contact with the soil. Used for fence posts and rails, cooperage, fuel, etc., and sometimes substituted for Ash. The oil of sassafras which is used to scent soap and liniment is distilled from the roots and root-bark of this species. Sassafras tea is prepared by boiling the small roots in water.



Red Gum, Sweet Gum, Bilsted

Liquidambar styraciflua L.

1. A twig showing staminate and pistillate inflorescences, and immature leaves $\times \frac{1}{2}$
2. A stamen, lateral view $\times 6$
3. A pistillate flower, lateral view $\times 6$
4. A branch showing mature leaves and fruit $\times \frac{1}{2}$
5. Winged seed, lateral view $\times 2$
6. Winter twig $\times \frac{1}{2}$
7. Portion of twig with corky wings $\times 1$

HAMAMELIDACEAE

Liquidambar styraciflua L.

Red Gum, Sweet Gum, Bilsted

Habit—An important timber species, at its best 80–120 feet in height with a trunk diameter of 3–4 feet, under optimum conditions sometimes 150 feet tall with a trunk 4–5 feet through. Bole tapering, continuous into the crown. Crown at first pyramidal and symmetrical, becoming narrowly oblong in older trees. An intolerant species, requiring an abundance of light for development. Sprouts abundantly from the stump but propagation by sprouts is not satisfactory.

Leaves—Alternate, nearly orbicular, 6–7 inches in diameter, truncate or cordate at the base, deeply 5–7-lobed (star-shaped) and palmately veined, the lobes acuminate, widely divergent and finely glandular-serrate. At maturity the leaves are thin, smooth, lustrous and bright green above, green and smooth below except for tufts of rufous hairs in the vein-axils. Petioles slender, 5–7 inches long. The foliage exhales a pleasant resinous fragrance when crushed.

Flowers—Appearing in the North during May on the growth of the season when the leaves are about one-third grown, monoecious, borne in capitate heads, subtended by 4 deciduous bracts. Staminate heads about $\frac{1}{4}$ of an inch in diameter, borne in terminal racemes. Staminate flowers without calyx or corolla; stamens indefinite in number, interspersed among minute scales. Pistillate heads about half an inch in diameter, borne solitary on long peduncles from the axils of the upper leaves. Pistillate flowers interspersed among long-awned scales; calyx obconic; stamens 4, inserted on the summit of the calyx, usually sterile; pistil consisting of an inferior ovary surmounted by 2 elongated, recurved, persisting, subulate styles stigmatic on the inner surface; ovules numerous.

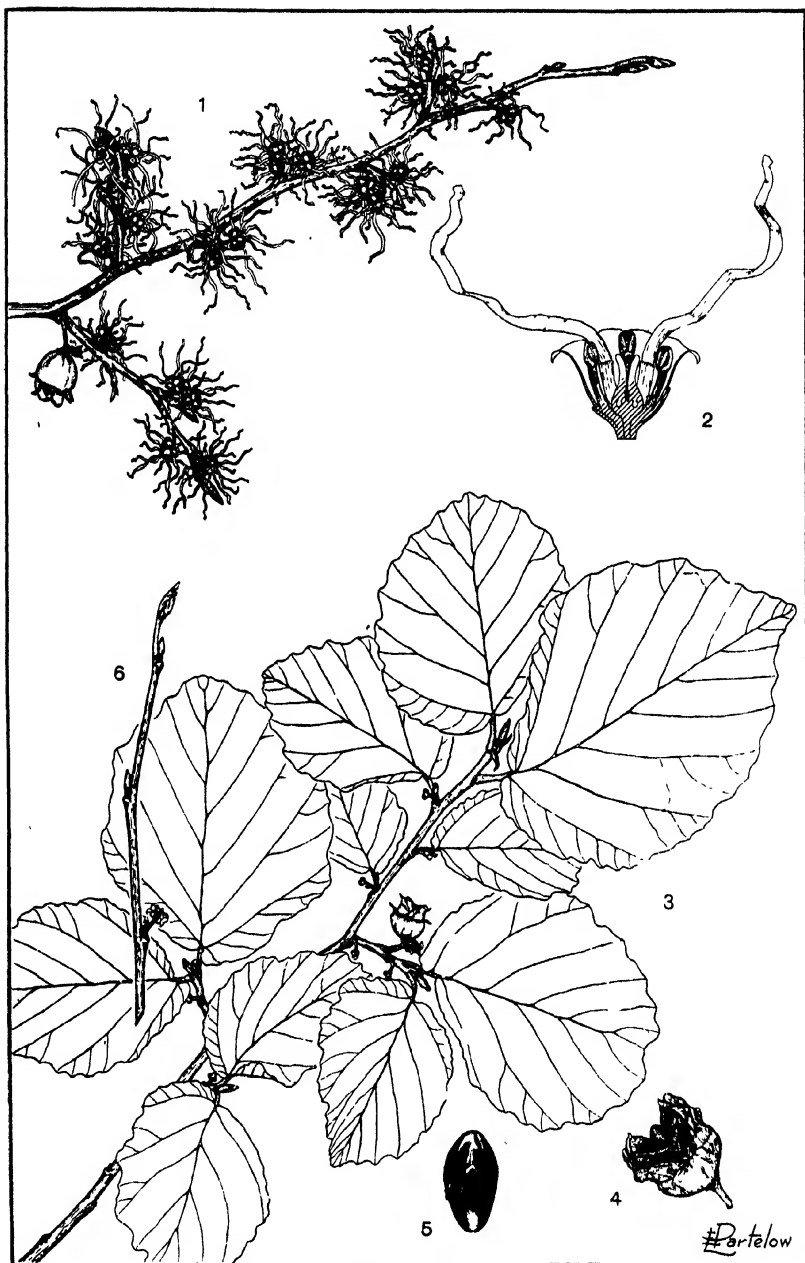
Fruit—A long-stalked, globose, light brown, aggregate head, 1– $1\frac{1}{2}$ inches in diameter, consisting of many, imbedded, woody capsules, each capped by the 2 horn-like, wide-spreading, woody styles. The fruits mature in autumn but persist far into the winter. Fertile seeds angular, winged, light brown, seldom more than one to a capsule. Sterile seeds numerous, resembling sawdust, rattling out of the capsules along with the fertile seeds at maturity.

Winter characters—Twigs rather stout, glabrous, somewhat angled and lustrous, roughened by dark, raised lenticels, light orange to reddish brown, becoming darker the second season and often developing characteristic corky wings. Pith pale brown, rather large and angular. Buds ovate to conical, obtuse or acute, lustrous orange-brown, $\frac{1}{4}$ – $\frac{1}{2}$ of an inch in length, fragrant when crushed. On vigorous shoots some of the lateral buds frequently develop into branches the first season. Mature bark thick, dark reddish brown, with deep furrows and broad, flat-topped, scaly ridges.

Habitat—A bottomland species preferring the deep, rich, moist soils of river flats, and the borders of swamps and lakes where the ground is inundated for a period each year. Forms open, even-aged groves, or grows in admixture with the Water Oaks, Cottonwood, Ash, Cypress, etc.

Range—Southwestern Connecticut, Long Island and Staten Island, N.Y., westward through Pennsylvania, southern Ohio and southeastern Missouri to Oklahoma, south to central Florida and eastern Texas.

Uses—An important timber species. Wood moderately hard, medium heavy, weak, straight- or frequently interlocked-grained, carneus-gray to reddish brown and the darker grades often with darker streaks of pigment-figure, with thin, nearly white sapwood. Widely used for loose cooperage, veneer, boxes, crates, woodenware and for interior finish. In the trade the carneus-gray stock is marketed as 'sap gum' while the terms 'plain red gum' and 'figured red gum' are applied to unfigured and figured reddish brown stock, respectively. The brown heartwood is sold as 'satin walnut' in Europe, the sapwood frequently as 'hazel pine.' Red gum is grown as an ornamental because of its odd-shaped leaves which turn crimson in the autumn.



Witch Hazel

Hamamelis virginiana L.

1. A twig (autumn) showing flowers and one mature fruit $\times 1$
2. A flower, lateral sectional view $\times 5$
3. A twig showing mature leaves, flower-buds, and mature capsule $\times \frac{1}{2}$
4. Opened capsule showing two seed compartments and one seed $\times 1$
5. Seed, lateral view $\times 2$
6. Winter twig $\times \frac{1}{2}$

HAMAMELIDACEAE
***Hamamelis virginiana* L.**
Witch Hazel

Habit—Usually a stout shrub sending up numerous branches from the ground, occasionally a small tree 25—30 feet in height with a short trunk which at the optimum range of the species, may attain a diameter of 14 inches. Trunk short in the arborescent form, bearing numerous, spreading, crooked, rigid branches and slender flexible branchlets which form a broad, open crown.

Leaves—Deciduous, alternate, simple, obovate to oval, 4—6 inches long, 2—2½ inches broad, obtusely short-acuminate or obtusish, narrowed toward the base and subcordate or rarely broad-cuneate, coarsely crenate-dentate, with 5—7 pairs of veins, at maturity membranous, dull dark green and glabrous or with occasional white hairs above, pubescent or puberulous on the veins below, borne on stout, pubescent petioles ¼—½ths of an inch in length.

Flowers—Appearing in September and October, perfect, 1—1½ inches in diameter, in short-peduncled, few-flowered clusters developed from the axils of leaves of the year. Calyx 4-parted, adnate to the base of the ovary, with spreading, ovate, obtuse, ciliate-margined lobes, densely pale-pubescent on the outside, dull brownish yellow inside. Petals 4, alternate with the sepals, inserted on the margin of the cup-shaped receptacle, bright yellow, strap-shaped, crumpled in the bud, ½—¾ of an inch long. Stamens 4, with yellow anthers and short filaments, inserted on the margin of the cup and alternating with scale-like staminodes, the latter opposite the petals. Pistil consisting of a partly superior, 2-celled ovary capped by two subulate, spreading styles which are stigmatic at the apex; ovules one or two in each cell, becoming solitary by abortion. The petals and stamens fall as soon as the ovules are fertilized; the styles persist in the fruit.

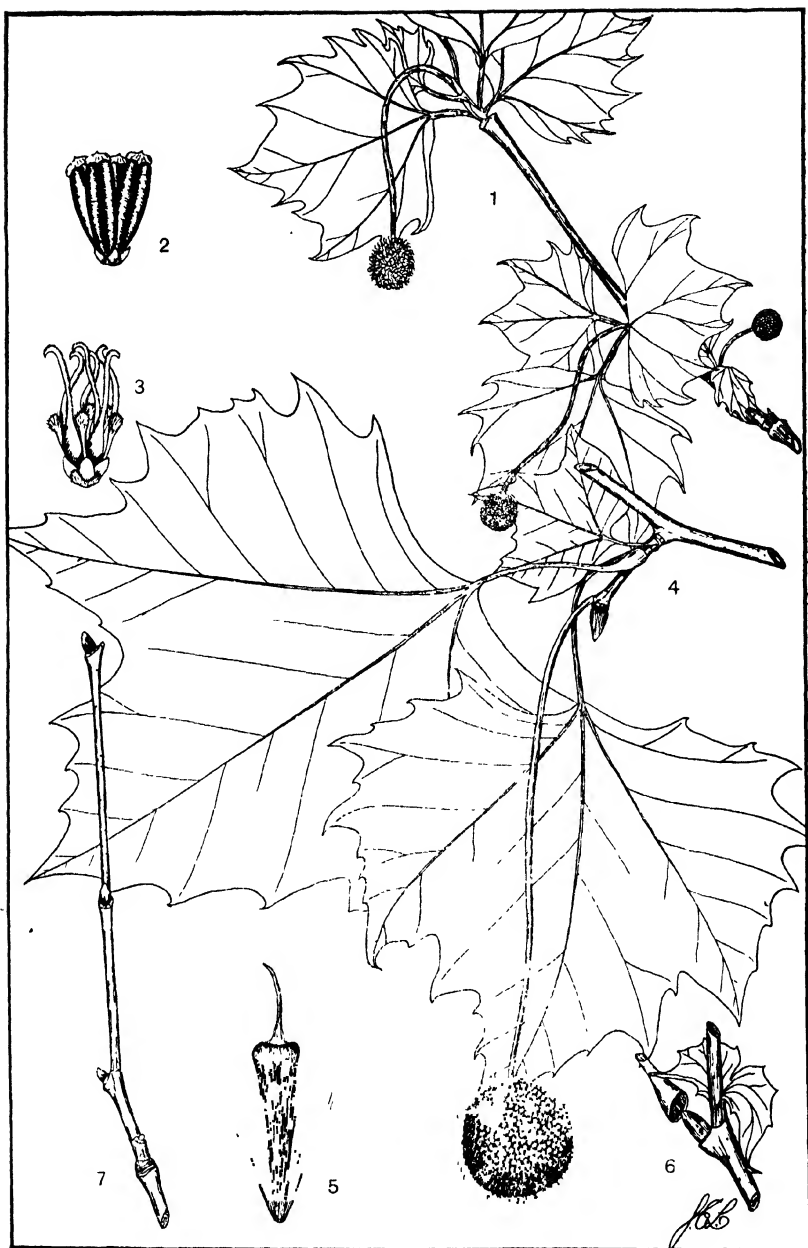
Fruit—A broadly obovoid, dull orange-brown, pubescent, 2-beaked, 2-valved capsule with the calyx-limb slightly below the middle, ½—¾ths of an inch long, ripening during the flowering period succeeding its formation. At maturity the capsule opens loculicidally from the top, the outer coat (exocarp) separating from the inner (endocarp) which encloses the seeds but soon burst elastically, catapulting the seeds with some force. Seeds two, large, black, lustrous, oblong, solitary in the cells of the capsule.

Winter characters—Twigs light orange-brown, shining, smooth or slightly puberulous, zigzag, marked by small, scattered, white lenticels, becoming dark or reddish brown during their second year. Buds stalked, flattish, slightly curved, essentially naked, consisting of a thick, laterally folded, undeveloped leaf densely covered with light to dark olive-brown pubescence which, with similar smaller leaves, serves the function of bud-scales; an outer pair of thin scales, corresponding to stipules, is sometimes present. Terminal bud larger than the laterals, ¼—½ of an inch long. Lateral buds rather widely spaced.

Habitat—A moisture-loving species occurring on the borders of woodlands and on damp sites around swamps, ponds and lakes. Occasionally at higher elevations on moist rocky outcrops. Shade-enduring and hence often found in the understorey of the forest.

Range—Nova Scotia, New Brunswick, and the valley of the St. Lawrence River to southern Ontario, southern Wisconsin and Minnesota, and northeastern Iowa, south to Georgia and Arkansas.

Uses—The wood is hard, heavy and close grained, but is not used commercially because of the small stature of the tree. The bark, twigs and leaves contain appreciable amounts of tannin and the alcoholic extract, known popularly as 'extract of witch hazel' and widely used as a household medicine, is obtained from this source. The common name, witch hazel, is said to have been assigned to this species because of the use of the twigs as divining rods to locate water and minerals. Witch hazel has distinct ornamental value, in part because of its late flowering, and is to be recommended within its proper habitat where natural effects are sought in planting.



Sycamore, Buttonwood, Plane Tree

Platanus occidentalis L.

1. A twig showing staminate and pistillate inflorescences, and mature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 5$
3. A pistillate flower, lateral view $\times 5$
4. A branch showing mature leaves and fruit $\times \frac{1}{2}$
5. An achene with pappus-wing $\times 3$
6. A twig-node showing persistent stipules, bud, and hollow leaf-stalk $\times 1$
7. Winter twig $\times \frac{1}{2}$

PLATANACEAE

Platanus occidentalis L.*

Sycamore, Buttonwood, Plane Tree

Habit—Perhaps the most massive tree of eastern North America, commonly over 100 feet in height with a trunk diameter of 3–8 feet, under optimum conditions occasionally 150–170 feet tall with a trunk 11 feet in diameter at the base. Bole erect or often declined, tapering, continuous through the oblong head or soon breaking up near the ground into several large, massive limbs to form a broad, rounded, irregular crown which is sometimes over 100 feet in diameter. Young trees sprout vigorously from the stump. A very intolerant species.

Leaves—Alternate, broadly ovate to orbicular, 4–7 inches in diameter or much larger on vigorous shoots, truncate, slightly cordate or cuneate at the base, shallowly 3–5-lobed and palmately veined the lobes broad, acuminate, sinuate-dentate with remote acuminate teeth, or entire with undulate margins. At maturity the leaves are thin, firm, smooth and bright green above, paler and glabrous below except for slight pubescence on the principal veins. Stipules foliaceous, conspicuous. Petioles stout, 3–5 inches long.

Flowers—Appearing on the growth of the season during May when the leaves are about one-fourth grown, monoecious, borne in capitate heads. Staminate heads dark red, about $\frac{1}{4}$ of an inch in diameter, borne axillary on long, stout, woolly peduncles. Perianth of 3–5 minute sepals and petals; stamens 3–6, nearly sessile, with yellow, clavate anthers. Pistillate heads pale green tinged with red, about $\frac{1}{2}$ of an inch in diameter, borne terminally on long, stout, woolly peduncles. Perianth of 3–6 sepals and petals; pistils as many as the sepals, superior, surrounded by a like number of spatulate staminodia, each consisting of an ovate-oblong ovary surrounded at the base by long pale hairs which persist in fruit, and a long, tapering, bright red style stigmatic along the ventral suture.

Fruit—A spherical, brown, aggregate head, about 1 inch in diameter, borne on a long, smooth peduncle $2\frac{1}{2}$ –6 inches long, consisting of many closely-packed, clavate, truncate or blunt, 1-seeded nutlets, each crowned by the remains of the persistent style and furnished with a ring of bristly hairs about the base. The heads mature in the late autumn but persist on the branches into the winter and following spring. Seed is produced in abundance but the vitality is low.

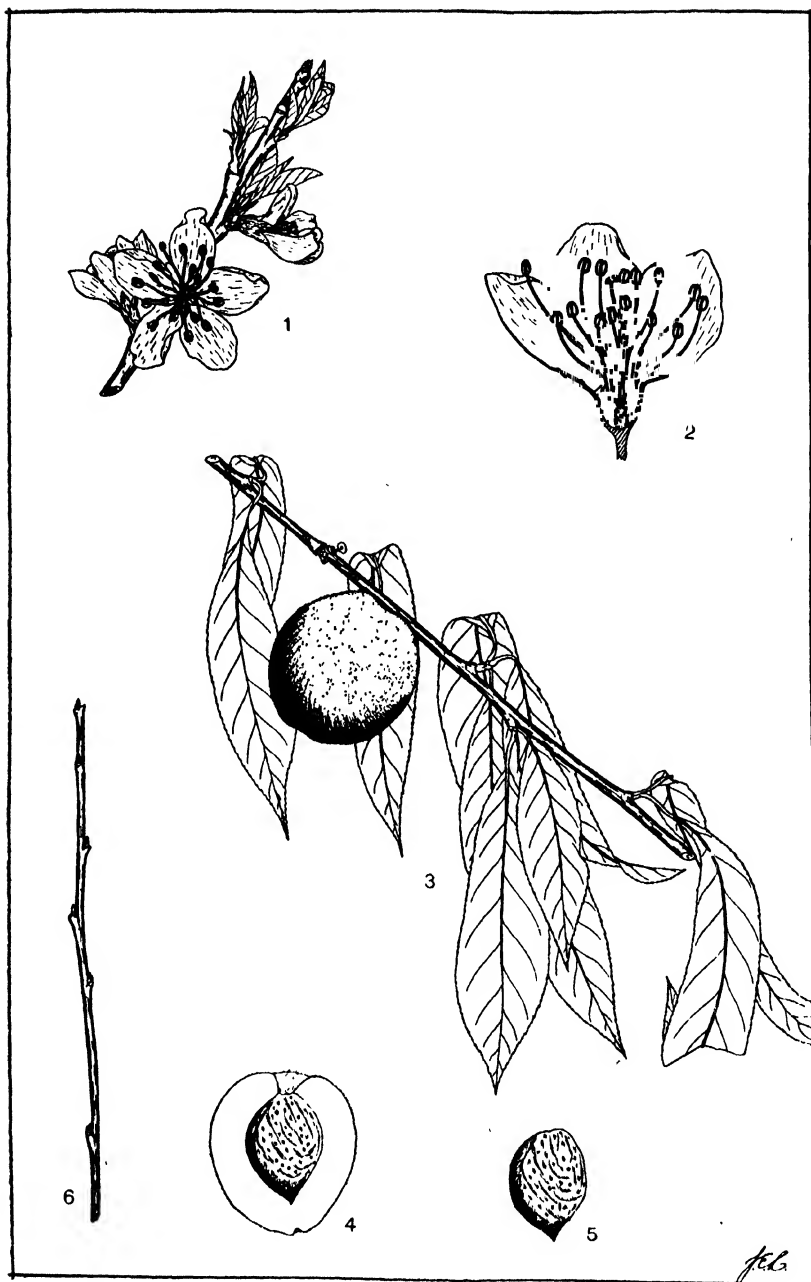
Winter characters—Twigs rather stout, smooth, somewhat lustrous, zigzag, enlarged at the nodes and encircled by stipule-scars, dark orange-brown, at length light gray. Pith white and rather broad. Terminal bud absent. Lateral buds divergent, conical, obtuse, lustrous, reddish brown, $\frac{1}{8}$ – $\frac{3}{8}$ of an inch long, subpetiolar until leaf-fall. Mature bark at base of trunk thick, dark brown, deeply furrowed with broad ridges which peel off as dark brown scales. On young trunks or large limbs the bark is much thinner and flakes off during the early summer in large plates, exposing an almost creamy-white inner bark and giving the tree a characteristic appearance.

Habitat—Thrives best along river banks and on rich, moist bottomlands, in open mixtures with other hardwoods. Attains its best development in the Ohio and Mississippi River Basins.

Range—Southwestern Maine through northern Vermont, southern Ontario, southern Michigan, and central and southern Iowa to southeastern Nebraska, south to western Florida and western Texas.

Uses—A timber species of secondary importance. Wood hard, heavy, weak, frequently interlocked-grained and difficult to split, not durable, light reddish brown with pale yellowish sapwood. Used for crates, tobacco boxes, butchers' blocks, slack cooorage, furniture, and for interior finish as quartered sycamore, sometimes under the name of Lacewood. Occasionally planted ornamentally.

*The London Plane, *X Platanus acerifolia* Willd., which is frequently grown as a street tree and of which a number of varieties are recognized, is considered to be a hybrid between *Platanus occidentalis* *X* *Platanus orientalis* L. In this form the inner bark is more olive-green, the middle lobe of the leaf is about as broad as long (broader than long in *Platanus occidentalis*), and two or rarely more fruiting heads are borne on the same stalk.



Peach

Prunus persica (L.) Batsch. [*Amygdalus persica* L.;
Persica vulgaris Mill.]

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 1$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times \frac{1}{2}$
5. Stone, lateral view $\times \frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE

Prunus persica (L.) Batsch. [*Amygdalus persica* L.;
Persica vulgaris Mill.]

Peach

Habit—A small tree usually about 20 feet in height with a trunk diameter of 5–6 inches, occasionally 25–30 feet tall. Bole short, breaking up 2–4 feet from the ground into stout, ascending limbs and branches to form a low, broad, globose crown.

Leaves—Alternate, elliptic-lanceolate to oblong-lanceolate or oblanceolate, long-acuminate at the apex, broad-cuneate at the base, serrate or serrulate, at maturity light green, glabrous and lustrous above, paler and glabrous beneath, borne on stout, glandular petioles $\frac{1}{2}$ – $\frac{3}{4}$ of an inch long.

Flowers—Appearing in April and May before the leaves, solitary, perfect, $\frac{1}{2}$ –2 inches broad, borne laterally on short pedicels from scaly buds formed the previous season in the leaf-axils. Calyx-tube cup-shaped, pubescent within, 5-lobed, the lobes obovate, acute, purplish green. Petals pink, oval, obtuse at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens 20–30, with long slender filaments and oval anthers. Pistil sessile, inserted at the base of the calyx-tube, consisting of a 1-celled, pubescent ovary surmounted by a simple style and a small, capitate stigma.

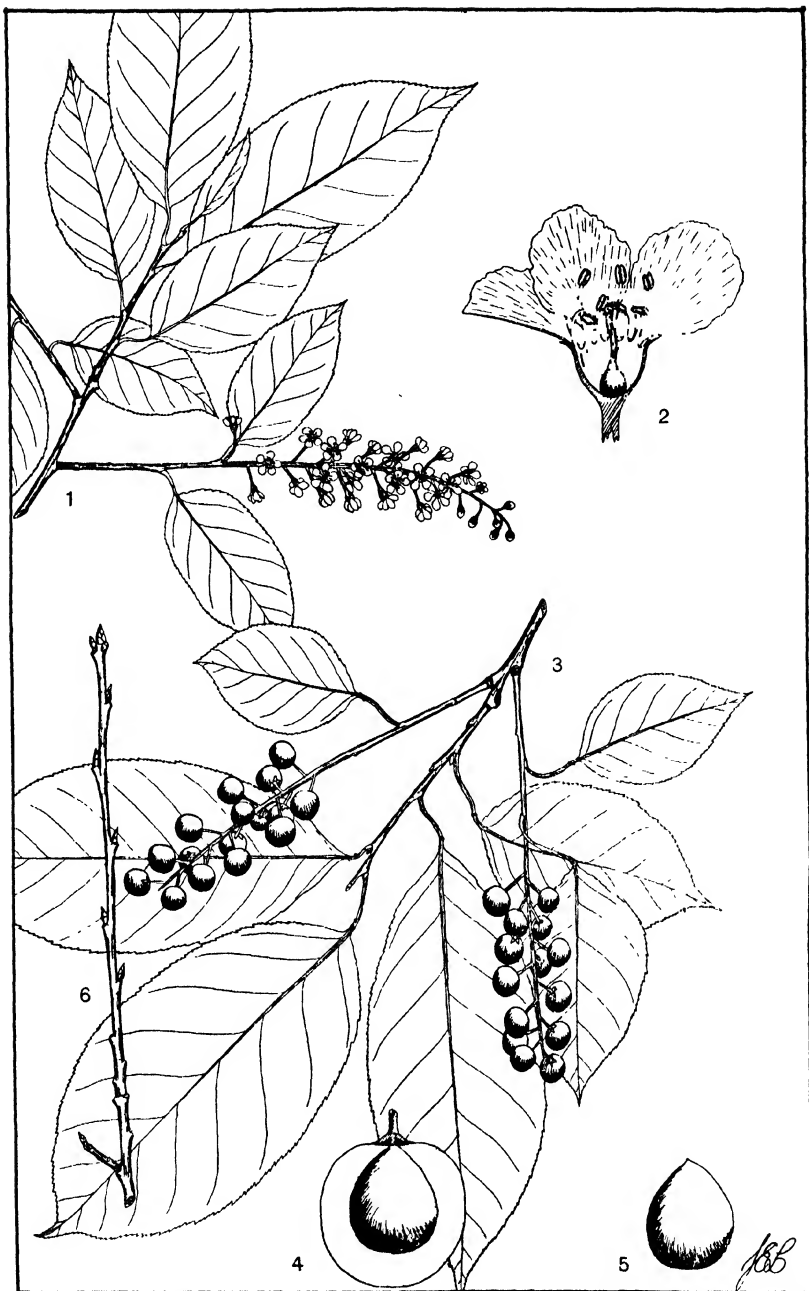
Fruit—A short-stalked, globose, laterally grooved, velvety-tomentose, yellowish green drupe, 1–3 inches in diameter, maturing in late summer or early autumn and becoming roseate or reddish pink. Flesh thick, aromatic, mildly acidulous and sweet, adhering to or free from the stone. Stone ovoid, laterally compressed, apiculate at one end, deeply wrinkled and pitted, thick-walled. Seed aromatic, rather bitter, pale brown.

Winter characters—Twigs medium stout, glabrous, lustrous, pale-punctate-lenticellate, greenish or reddish purple where exposed to direct sunlight, green below. Bruised twigs with the odor and taste of bitter almonds. Flower- and leaf-buds separate. Leaf-buds ovate, obtuse, densely pale-woolly-tomentose, about $\frac{1}{4}$ of an inch long. Flower-buds stouter than the leaf-buds, usually accessory and lateral to the leaf-buds. Mature bark thin, dark reddish brown, smooth aside from the prominent, horizontally elongated lenticels, becoming rougher and scaly at the base of the bole.

Habitat—An occasional 'escape' in waste places along fences, high roads and about habitations, probably where the pits are dropped by man. Prefers protected sites where the climate is mild, conditions frequently found in the proximity of large bodies of water.

Range—Supposed originally to have been a native of eastern Asia but long cultivated in North America for its fruit.

Uses—This species in its numerous varieties produces the peaches of commerce. Two well-marked strains, the 'cling stones' and the 'free stones' have been evolved. The fruit of the wild form is far inferior to that of the cultivated forms. Double-flowered, dwarf forms with conspicuous flowers, etc., are grown ornamentally. During the World War, peach pits were used in the manufacture of gas masks.



Black Cherry, Rum Cherry

Prunus serotina Ehrh.

- | | |
|--|--------------------------------------|
| 1. A twig showing flowers and imma- ture leaves x $\frac{1}{2}$ | and fruit x $\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 4 | 4. Fruit, lateral sectional view x 2 |
| 3. A branch showing mature leaves | 5. Stone, lateral view x 2 |
| 6. Winter twig x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE
***Prunus serotina* Ehrh.**

Black Cherry, Rum Cherry

Habit—The largest of the cherry trees occurring in the United States, commonly 50—60 feet in height with a trunk diameter of 2—3 feet, under favorable conditions sometimes 100 feet tall and 5 feet through at the butt. Under forest conditions the bole is long, clean, with but slight taper. Trees in the open have a short bole which continues into the narrowly oblong, irregular crown. Grows rapidly but frequently damaged by forest fires.

Leaves—Alternate, oval to oblong-ovate and oblong-lanceolate, 2—6 inches long, 1—1½ inches wide, acuminate or abruptly pointed at the apex, cuneate or rounded at the base, finely serrate with small, incurved callous teeth, at maturity thickish, glabrous, dark green and lustrous above, paler and glabrous below or villous along the midrib, borne on slender, biglandular petioles ¼—½ of an inch long.

Flowers—Appearing in May or June when the leaves are nearly grown, perfect, ¼—½ of an inch broad, borne on short pedicels in many-flowered, erect or nodding racemes which are 3—6 inches long and terminate short leafy branches. Calyx-tube cup-shaped, glabrous or slightly puberulous, 5-lobed, the lobes ovate-oblong, obtuse, reflexed at maturity, persistent. Petals white, broadly obovate, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens with glabrous, filiform filaments and oval anthers. Pistil consisting of a green, glabrous, 1-celled ovary, thick style, and clavate stigma.

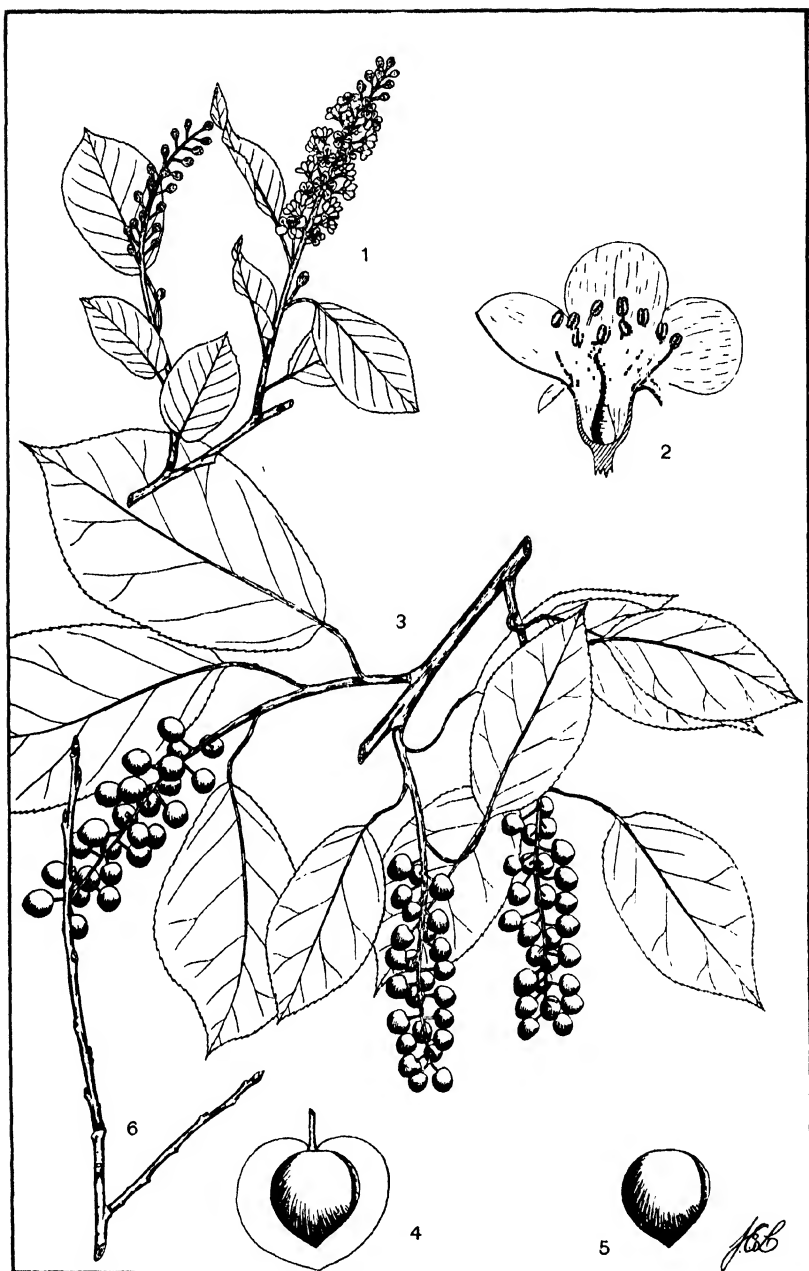
Fruit—A globose, short-stalked, dark red, lustrous drupe, ½—¾ of an inch in diameter, borne in drooping racemose clusters, ripening in August and September and turning dark purple or black. Skin thick. Flesh thin, juicy, dark purple, of a vinous flavor when fully ripe. Stone obovoid, thin-walled, broadly ridged on one side, about ½ of an inch long. Seed is produced in abundance and is widely spread by birds.

Winter characters—Twigs slender, glabrous, reddish or grayish brown, marked with numerous, pale lenticels, often covered in part with a thin, grayish, evanescent skin which rubs off easily. Bruised twigs have the odor and taste of bitter almonds. Buds ovate, acute, somewhat lustrous, chestnut-brown, divergent or flattened and appressed, ⅛—¼ of an inch long. Mature bark thin, dark reddish brown, reticulately fissured into small, scaly, persisting plates with upraised edges.

Habitat—A long-taprooted species, preferring a deep soil. Thrives on the moist alluvial soils of river-bottoms and fertile slopes in mixture with other hardwoods but occurs in drier situations on a variety of soils. Occasional on sandy soils in the Spruce, White Pine, Hardwood mixture of the Adirondacks. Under forest conditions it usually grows solitary or in small groves, intermixed with other species.

Range—Nova Scotia westward through southern Canada to the north shore of Lake Superior and eastern North Dakota, south to south-central Florida and eastern Texas.

Uses—One of the most valuable timber trees of the forests of the eastern United States. Wood rather hard, medium heavy, strong, close-grained, light to dark reddish brown with thin yellow sapwood. Valuable for furniture, cabinet making, interior finish, musical instruments, piano actions, electrotypes and engraving blocks, etc. Supply largely depleted through inroads made by furniture manufacturers. The delicate, nodding racemes of small, white flowers and dark green, subcoriaceous leaves render this species of ornamental value. An extract made from the bark is used medicinally.



Choke Cherry

Prunus virginiana L. [*Prunus nana* Dur.; *Padus virginiana* (L.) Roem.]

- | | |
|---|--------------------------------------|
| 1. A twig showing flowers and immature leaves x $\frac{1}{2}$ | 4. Fruit, lateral sectional view x 2 |
| 2. A flower, lateral sectional view x 4 | 5. Stone, lateral view x 2 |
| 3. A branch showing mature leaves and fruit x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Prunus virginiana L. [*Prunus nana* Dur.; *Padus virginiana* (L.) Roem.]

Choke Cherry

Habit—A shrub or small tree 20—25 feet in height with a trunk diameter of 4—8 inches, occasionally 35 feet tall with a bole 12 inches through. Trunk usually inclined. Crown narrow, irregular.

Leaves—Alternate, broad-elliptical to obovate, 2—4 inches long, 1—2 inches wide, abruptly acuminate at the apex, broad-cuneate to rounded at the base, sharply and often doubly serrate with spreading subulate teeth, at maturity thin, dark green and glabrous above, paler and quite glabrous beneath, borne on slender, biglandular petioles $\frac{1}{2}$ —1 inch long.

Flowers—Appearing in May or June when the leaves are nearly grown, perfect, $\frac{1}{3}$ — $\frac{1}{2}$ of an inch broad, borne on short pedicels in many-flowered, erect or nodding racemes which are 3—6 inches long and terminate short leafy branches. Calyx-tube cup-shaped, glabrous, 5-lobed, the lobes short, broad, obtuse, reflexed, early deciduous. Petals 5, white, orbicular, short-clawed at the base and inserted with the stamens on the calyx-tube. Stamens with filiform filaments and oval anthers. Pistil consisting of a green, glabrous, 1-celled ovary, short thick style, and broad, simple stigma.

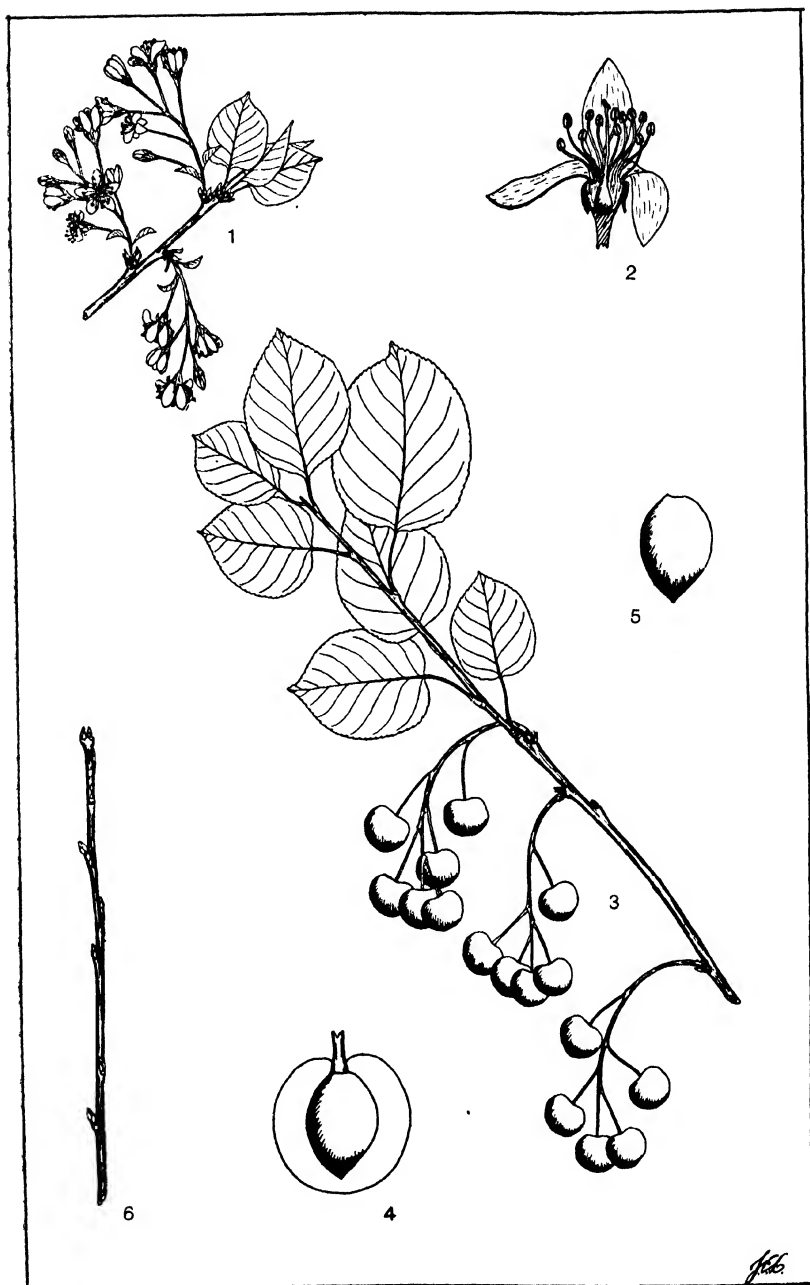
Fruit—A short-stalked, globose, bright red, lustrous drupe, $\frac{1}{4}$ — $\frac{1}{3}$ of an inch in diameter, borne in drooping racemose clusters, ripening in July and August and turning dark crimson or nearly black. Skin thick. Flesh thin, juicy, dark colored, very puckery until dead ripe. Stone globose, apiculate, ridged on one side.

Winter characters—Twigs slender to medium stout, glabrous, light brown to reddish brown, with small, punctate, pale-yellowish lenticels. Bruised twigs with rank odor and bitter taste. Buds conical to ovate, acute, glabrous, pale chestnut-brown, $\frac{1}{4}$ — $\frac{1}{3}$ of an inch long. Mature bark thin, grayish brown, smooth aside from the rounded lenticels, in age somewhat roughened by shallow ridges.

Habitat—On a variety of soils along fences, highroads, stream courses, in open woods, and on waste land, often forming thickets. Spreads by means of root-suckers and by seeds disseminated by birds.

Range—Newfoundland to Saskatchewan, eastern North Dakota, and eastern Nebraska, south to North Carolina, Missouri, and Kansas.

Uses—An obnoxious 'weed' shrub and tree. The seeds are sown by the birds along fences and hedge rows and soon produce extensive thickets which are difficult to eliminate owing to the formation of numerous root-suckers. Of no commercial value. The name, 'Choke Cherry', is apropos because of the puckery nature of the fruit before it becomes dead ripe.



Mahaleb Cherry, St. Lucie Cherry

***Prunus mahaleb* L.**

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2\frac{1}{2}$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times 2$
5. Stone, lateral view $\times 2$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE
***Prunus mahaleb* L.**

Mahaleb Cherry, St. Lucie Cherry

Habit—A small, slender tree 25—35 feet in height with a trunk diameter of 6—12 inches, or a flowering shrub. Role short, breaking up a short distance above the ground into stout, ascending branches to form a broad, low, rounded crown.

Leaves—Alternate, round-ovate to orbicular, 1—2½ inches in diameter, obtusely short-acuminate at the apex, rounded or somewhat cordate at the base, finely callous-serrate, at maturity thin, firm, light green and smooth above, of the same color and smooth below except on the midrib, fragrant, borne on slender petioles ½—1 inch long.

Flowers—Appearing in May and June when the leaves are partly grown, fragrant, perfect, white, about ⅓ of an inch broad, borne on stout pedicels in 6—10-flowered, racemose corymbs terminal on short leafy branches of the year. Calyx-tube urn-shaped, glabrous, with 5 strongly reflexed lobes. Petals 5, white, obovate, obtuse, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with slender filaments and oblong anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style, and broad, simple stigma.

Fruit—A depressed-globose or globose-ovoid, long-stalked, reddish black, lustrous, unpalatable drupe, about ¼ of an inch in diameter, ripening in early summer. Flesh thin, firm, bitter. Stone small, globose, slightly compressed.

Winter characters—Twigs slender, glabrous, grayish red and lustrous, fragrant. Buds ovate, acute, grayish red, those near the branch-tip somewhat clustered. Mature bark thin, close, dark gray, somewhat roughened by shallow ridges. Inner bark aromatic.

Habitat—In waste places along roadsides, fence rows, and about abandoned homesteads, preferring a moist, rich soil.

Range—Native to middle and southern Europe, and southeastern Asia. Sparingly naturalized in the Northeast as an 'escape.'

Uses—Introduced from abroad as a stock on which to graft garden cherries. A number of varieties are recognized. Wood hard, heavy, close-grained, fragrant, dark red. Prized abroad as a cabinet wood and for the manufacture of small trinkets. The species has ornamental value but is seldom used here.



Pin Cherry, Wild Red Cherry, Bird Cherry, Fire Cherry

Prunus pennsylvanica L. f.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 3$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Portion of leaf-margin, enlarged.
5. Fruit, lateral sectional view $\times 2\frac{1}{2}$
6. Stone, lateral view $\times 2\frac{1}{2}$
7. Winter twig $\times \frac{1}{2}$

ROSACEAE
***Prunus pennsylvanica* L. f.**

Pin Cherry, Wild Red Cherry, Bird Cherry, Fire Cherry

Habit—Usually a shrub or small tree 20—30 feet in height with a trunk diameter of 6—10 inches, under optimum conditions occasionally 40 feet tall. Trunk short, continuous into the crown. Crown narrowly oblong, somewhat rounded at the top, consisting of slender, ascending branches.

Leaves—Alternate, oblong-lanceolate and occasionally slightly falcate, 3—4½ inches long, ¾—1¼ inches wide, acuminate or rarely acute at the apex, rounded or broad-cuneate at the base, finely and sharply serrulate with incurved, often glandular teeth, bronze-green and slightly viscid when they unfold, at maturity thin, yellow-green, smooth and lustrous above, paler and smooth below, borne on slender, glabrous or slightly pilose petioles ½—1 inch long.

Flowers—Appearing in May or early June when the leaves are about one-fourth grown, perfect, about ½ of an inch broad, borne on slender pedicels about 1 inch long in 4—5-flowered, short-pedunculate, 2—3-clustered umbels. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes oblong, obtuse, red-margined, reflexed at maturity. Petals 5, creamy-white, nearly orbicular, clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style, and a broad, simple stigma.

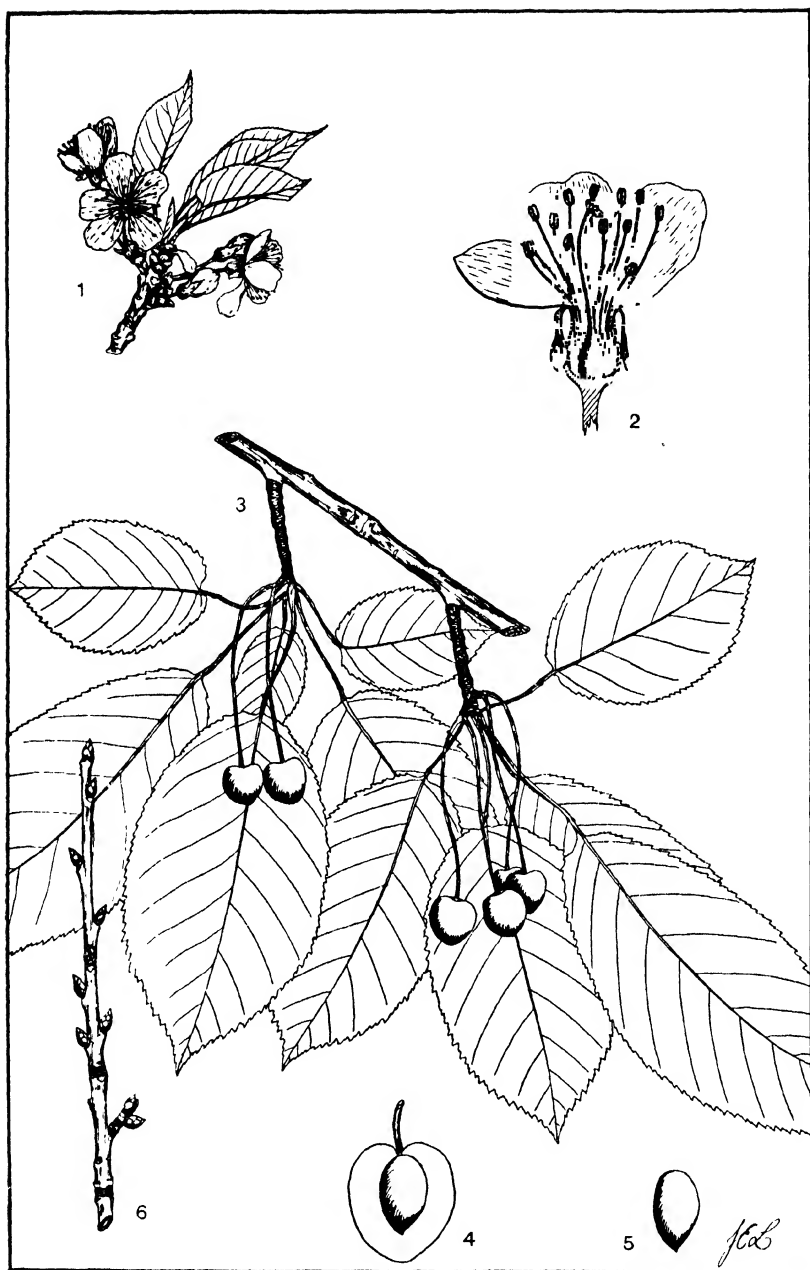
Fruit—A very long-stalked, globose, thick-skinned, light red drupe, about ¼ of an inch in diameter, maturing in July and early August. Flesh thin, sour. Stone oblong, apiculate at the apex, thin-walled, slightly compressed, ridged on one side, about ⅓ of an inch long.

Winter characters—Twigs slender, glabrous, bright red and lustrous or partly covered with a grayish, evanescent skin, with prominent, pale lenticels. Broken twigs have a characteristic bitter taste and odor. Buds ovate, obtuse, reddish brown, clustered at the twig-tip and sometimes along the sides, about ⅓ of an inch long. Mature bark thin, reddish brown, smooth aside from the large, horizontally elongated lenticels. Inner bark bright green.

Habitat—A 'weed' tree which is widely distributed through seeds scattered by birds. Occurs in fence rows, abandoned pastures, along road sides, and on limestone outcrops. Comes in rapidly in burns and slashes after deforestation, often mixed with Aspen. Provides a temporary ground-cover until overshadowed by the more important timber species.

Range—Newfoundland to British Columbia, south to Pennsylvania, central Michigan, northern Illinois, central Iowa and Colorado, and in the Allegheny Mountains to western North Carolina and eastern Tennessee.

Uses—Not a timber species. Its chief value lies in its ability to establish itself rapidly after deforestation and forest fires, protecting the soil and acting as a nurse-tree until other larger, more valuable, and longer-lived species occupy the site.



Sweet Cherry, Mazzard

Prunus avium L.

- | | |
|--|--|
| 1. A twig showing flowers and immature leaves $\times \frac{1}{2}$ | 3. A branch showing mature leaves and fruit $\times \frac{1}{2}$ |
| 2. A flower, lateral sectional view $\times 1\frac{1}{2}$ | 4. Fruit, lateral sectional view $\times 1\frac{1}{2}$ |
| | 5. Stone, lateral view $\times 1\frac{1}{2}$ |
| | 6. Winter twig $\times \frac{1}{2}$ |

ROSACEAE
Prunus avium L.

Sweet Cherry, Mazzard

Habit—Usually a medium-sized tree 30—50 feet in height with a trunk diameter of 1—2 feet, under favorable conditions sometimes 80 feet tall. Trunk tapering, continuous into the crown. Lateral branches slender, ascending, beginning a few feet above the ground, forming a narrow-pyramidal crown which becomes broad-spreading in age.

Leaves—Alternate, oblong-ovate to obovate, 2—6 inches long, abruptly short-acuminate at the apex, rounded or slightly cordate at the base, irregularly serrate, at maturity thin, rather flaccid, glabrous and often slightly rugose, dull dark green above, paler and pubescent on the veins beneath, borne on slender petioles $\frac{1}{4}$ —1 inch long.

Flowers—Appearing in April and May with the leaves, perfect, about 1 inch broad, borne on slender pedicels in 2—5-flowered, lateral, sessile umbels. Calyx-tube campanulate, glabrous, reddish at the top, 5-lobed, the lobes oblong, obtuse, reflexed. Petals 5, white, orbicular, shallowly notched at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style, and broad, simple stigma.

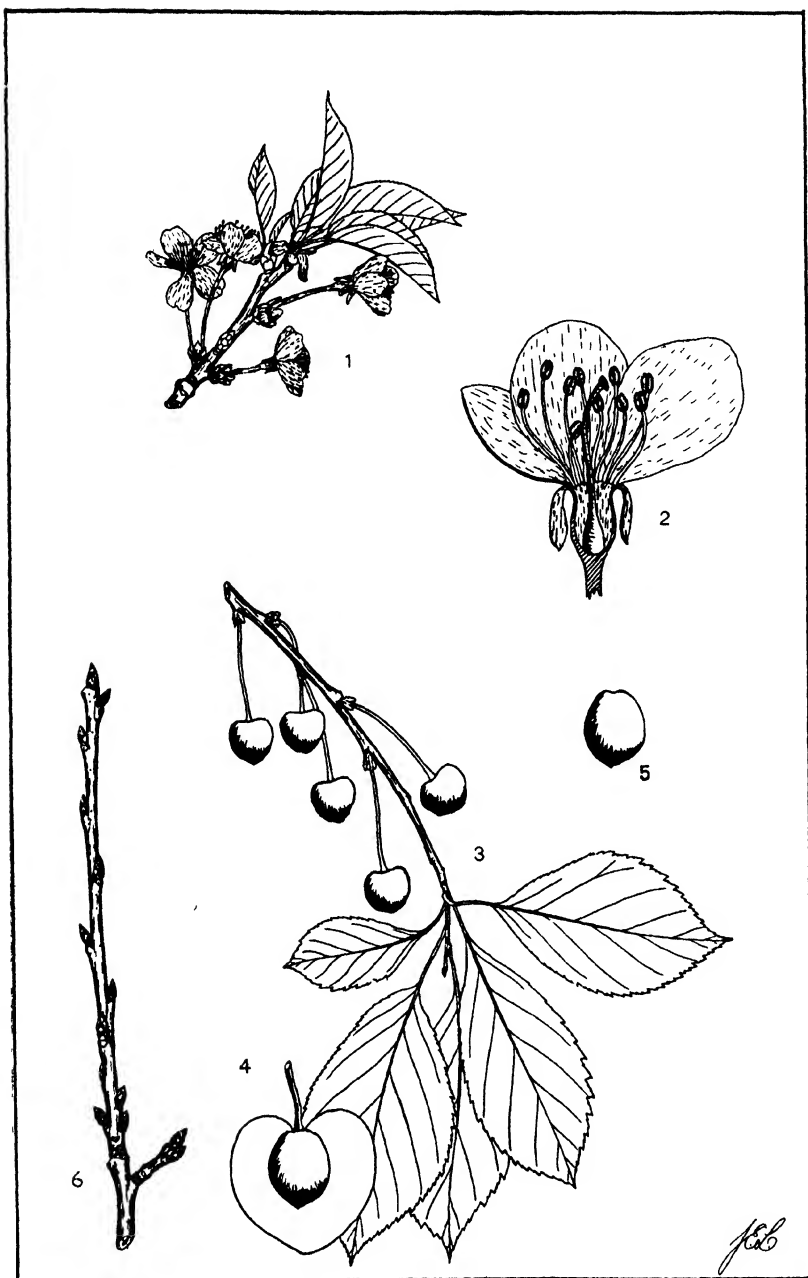
Fruit—A depressed-globose or ovoid, long-stalked, dark red or nearly black drupe, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch in diameter in the wild form, usually borne in clusters, appearing in June or July. Flesh sweet or somewhat tart, adhering to the globose or ovoid stone.

Winter characters—Twigs stout, glabrous, light reddish brown and lustrous or partly covered with a grayish, evanescent skin, with characteristic bitter taste and odor when broken. Older twigs with short, stout fruit-spurs marked with many leaf-scars and with terminally clustered buds. Buds ovate, acute, divergent, glabrous, reddish brown, clustered near the tips of the fruit-spurs or scattered on vigorous shoots, $\frac{1}{2}$ — $\frac{1}{4}$ of an inch long. Outer bark thin, reddish brown, smooth aside from the prominent, horizontally elongated lenticels, peeling off transversely to expose the lighter inner bark. Mature bark in old trees roughened with shallow ridges.

Habitat—An 'escape' in waste places along fences, hedge rows, roadsides, and in open woods. Widely disseminated through the agency of birds and hence known as European Bird Cherry.

Range—A native of southern Europe and western Asia but now widely naturalized in eastern United States. Said to have been introduced between 1621 and 1629.

Uses—Many of the cultivated garden cherries have been derived from this species and a number of hybrids are recognized. Ornamental varieties, including double-flowered forms, may be purchased from nurserymen. Wood heavy, rather soft, brittle, close-grained. Used abroad for the manufacture of furniture, musical instruments, and in turnery.



Sour Cherry, Morello Cherry

Prunus cerasus L.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times 1\frac{1}{2}$
5. Stone, lateral view $\times 1\frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE
Prunus cerasus L.

Sour Cherry, Morello Cherry

Habit—A small tree 20—30 feet in height with a trunk diameter of 10—12 inches, occasionally under favorable conditions 40 feet in height. Bole seldom more than 4—6 feet long, breaking up into stout, ascending, spreading branches to form a broad, low, rounded crown.

Leaves—Alternate, elliptic-obovate to ovate, $2\frac{1}{2}$ — $3\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches wide, acute or abruptly acuminate at the apex, cuneate or rounded at the base, finely and often doubly serrate, resinous when young, at maturity thick, firm, smooth, light or gray-green and more or less lustrous above, paler and smooth or slightly pubescent below, borne on slender, usually biglandular petioles $\frac{1}{2}$ —1 inch long.

Flowers—Appearing in April or May with the leaves, perfect, about 1 inch broad, borne on slender pedicels in 1—5-flowered, lateral, sessile umbels which are scaly at the base from the persisting, appressed scales of the flower-buds. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes oblong, obtuse, minutely glandular-serrate and reflexed. Petals 5, white, broadly obovate and sometimes notched at the summit, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style, and broad, simple stigma.

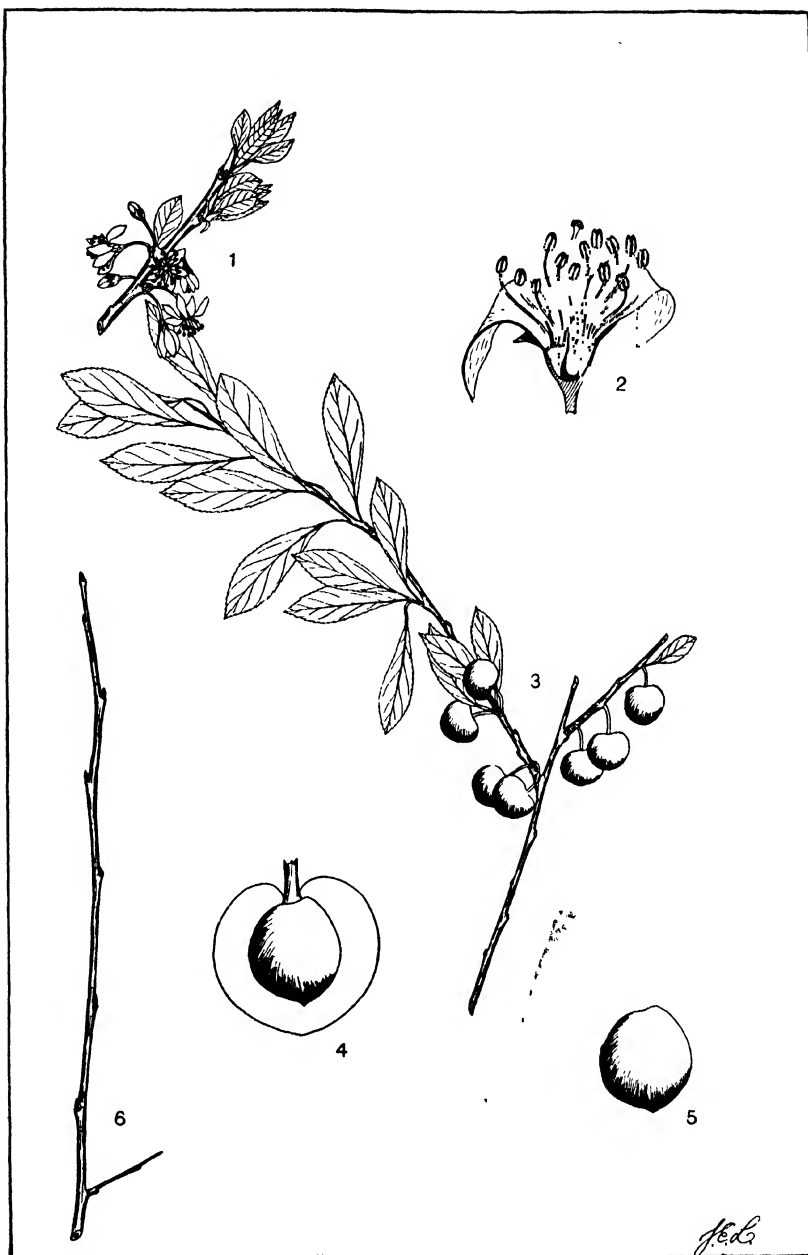
Fruit—A depressed-globose, long-stalked, red or reddish black drupe, about $\frac{1}{2}$ of an inch in diameter in the wild form, maturing in June or July. Flesh juicy, sour. Stone subglobose, apiculate at the apex, slightly ridged on one side.

Winter characters—Twigs rather stout, glabrous, red or grayish brown and somewhat lustrous or partly covered with a grayish evanescent skin, with characteristic bitter taste and odor when broken. Older twigs with short, stubby fruit-spurs. Buds ovate, acute, reddish brown, clustered near the tips of the fruit-spurs or scattered along vigorous shoots, about $\frac{1}{3}$ of an inch long. Outer bark thin, reddish brown, smooth aside from the prominent, horizontally elongated lenticels, soon peeling back to expose the rougher inner bark.

Habitat—In rich, moist soil about abandoned homesteads, along fences and roadsides and the margins of woods. Spreads readily from seeds or root-suckers.

Range—A native of southeastern Europe and western Asia but now widely naturalized as an 'escape' in eastern United States.

Uses—The importance of the species lies chiefly in its horticultural value as the source of various varieties of canning cherries. Several hybrids have been described. Wood heavy, rather soft, brittle, close-grained, reddish brown with paler sapwood. Used in Europe for furniture and interior finish.



Wild Bullace Plum, Wild Damson Plum

Prunus insititia L. [*Prunus spinosa* var. *insititia* (L.) Gray;

Prunus domestica var. *insititia* (L.) Waugh.]

- | | |
|---|--------------------------------------|
| 1. A twig showing flowers and immature leaves x $\frac{1}{2}$ | 4. Fruit, lateral sectional view x 2 |
| 2. Flower, lateral sectional view x $2\frac{1}{2}$ | 5. Stone, lateral view x 2 |
| 3. A branch showing mature leaves and fruit x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Prunus insititia L. [*Prunus spinosa* var. *insititia* (L.) Gray;
Prunus domestica var. *insititia* (L.) Waugh.]

Wild Bullace Plum,* Wild Damson Plum

Habit—Generally a bushy shrub 2—15 feet high with short, stiff, more or less spiny branches forming a dense, compact top, occasionally a small tree 20—25 feet in height with a trunk diameter of 5—8 inches and a narrow, compact, rounded crown. Produces abundant root-suckers.

Leaves—Alternate, elliptic to obovate and oblanceolate, $1\frac{1}{2}$ —2 inches long, broadly acute at the apex, attenuate at the base, sharply and somewhat doubly serrate, at maturity firm, dull dark green, reticulate-veined and glabrous above, paler and sparingly pubescent below, borne on slender petioles $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long.

Flowers—Appearing in April or May before or with the leaves, perfect, about $\frac{1}{2}$ of an inch broad, borne usually in 2-flowered, umbellate clusters from lateral buds on the growth of the preceding season. Calyx-tube campanulate, green, glabrous, 5-lobed, the lobes narrow and acute. Petals 5, elliptical, blunt at the apex, inserted with the stamens on the calyx-tube. Stamens about 30, with filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, a long filamentous style, and a capitate stigma.

Fruit—A pendulous, subglobose, glaucous, bluish black or rarely yellow drupe, $\frac{3}{4}$ — $\frac{1}{2}$ of an inch in diameter, maturing in July but usually persisting until winter, scarcely edible. Flesh thin, sweet, clinging to the stone. Stone oval, somewhat compressed, grooved on one side, nearly smooth.

Winter characters—Twigs slender, tomentose when young, lustrous, dark brown, at length becoming dark gray. Lateral spinescent spurs generally present. Terminal bud absent. Lateral buds ovate, acute, light brown, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. Mature bark thin, quite smooth, brownish black.

Habitat—An 'escape' that has become established around abandoned dwellings, along highroads and fence rows, and in waste places.

Range—Supposed to have been native originally to western Asia and Europe but cultivated since prehistoric times. Occasionally naturalized in the Northeastern States.

Uses—A 'weed' species. The botanical source of the Damson, Bullace, Mirabelle, and other kinds of cultivated plums. Resembles a wild or half-wild form of the Garden Plum, *Prunus domestica* L., and considered by some authorities to be a variety of this species to which the Garden Plum reverts through lack of cultivation. Wood hard, heavy, close-grained, reddish brown with paler sapwood. Occasionally used abroad for furniture and cabinet work.

*The Sloe or Blackthorn, *Prunus spinosa* L., which was originally introduced into this country as a hedge plant and since has been abandoned for this purpose, is found occasionally as an escape in the Northeastern States. It can be distinguished from the Wild Damson Plum by its black bark (hence the term—Black Thorn), from the manner in which the branchlets stand out at right angles to the branches and the abundance of thorns, by its round, blunt lateral buds, and by its usually solitary flowers and upright blue sour fruits somewhat larger than a pea in contrast to the larger bluish black or yellow fruits of *Prunus insititia*. The celebrated Blackthorn walking sticks are made from the young trunks and straight branches of this species.



Garden Plum

***Prunus domestica* L. [*Prunus communis* Huds.; *Prunus oeconomica* Borkh.; *Prunus damascena* Dierb.]**

- | | |
|---|---|
| 1. Portion of a twig showing flowers and immature leaves $\times \frac{1}{2}$ | 4. Fruit, lateral sectional view $\times \frac{3}{4}$ |
| 2. A flower, lateral sectional view $\times 2$ | 5. Stone, lateral view $\times \frac{3}{4}$ |
| 3. A branch showing mature leaves and fruit $\times \frac{1}{2}$ | 6. Winter twig $\times \frac{1}{2}$ |

ROSACEAE

Prunus domestica L. [*Prunus communis* Huds; *Prunus oeconomica* Borkh.; *Prunus damascena* Dierb.]

Garden Plum

Habit—A small tree attaining a height of 30–40 feet with a trunk diameter of 7–12 inches, or many times shrubby and forming extensive thickets by means of root-suckers. Trunk short, dividing 4–8 feet above the ground in stout, ascending limbs and many spreading, slender, slightly drooping branches to form a low, rounded crown.

Leaves—Alternate, varying greatly in form from ovate or oval to obovate, 2–3½ inches long, acute or acuminate at the apex, cuneate at the base, coarsely and irregular crenate-serrate, at maturity thick, firm, dull dark green and reticulate-veined above, paler, soft pubescent below, borne on stout petioles ½–1 inch long.

Flowers—Appearing in April or May with the leaves, perfect, about 1 inch broad, generally in 2-flowered, umbellate clusters from lateral buds on the growth of the preceding season. Calyx-tube cup-shaped, green, glabrous, 5-lobed, the lobes ovate, acute, reflexed after anthesis. Petals greenish white, oval or obovate, rounded at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, a long, filamentous style, and a capitate stigma.

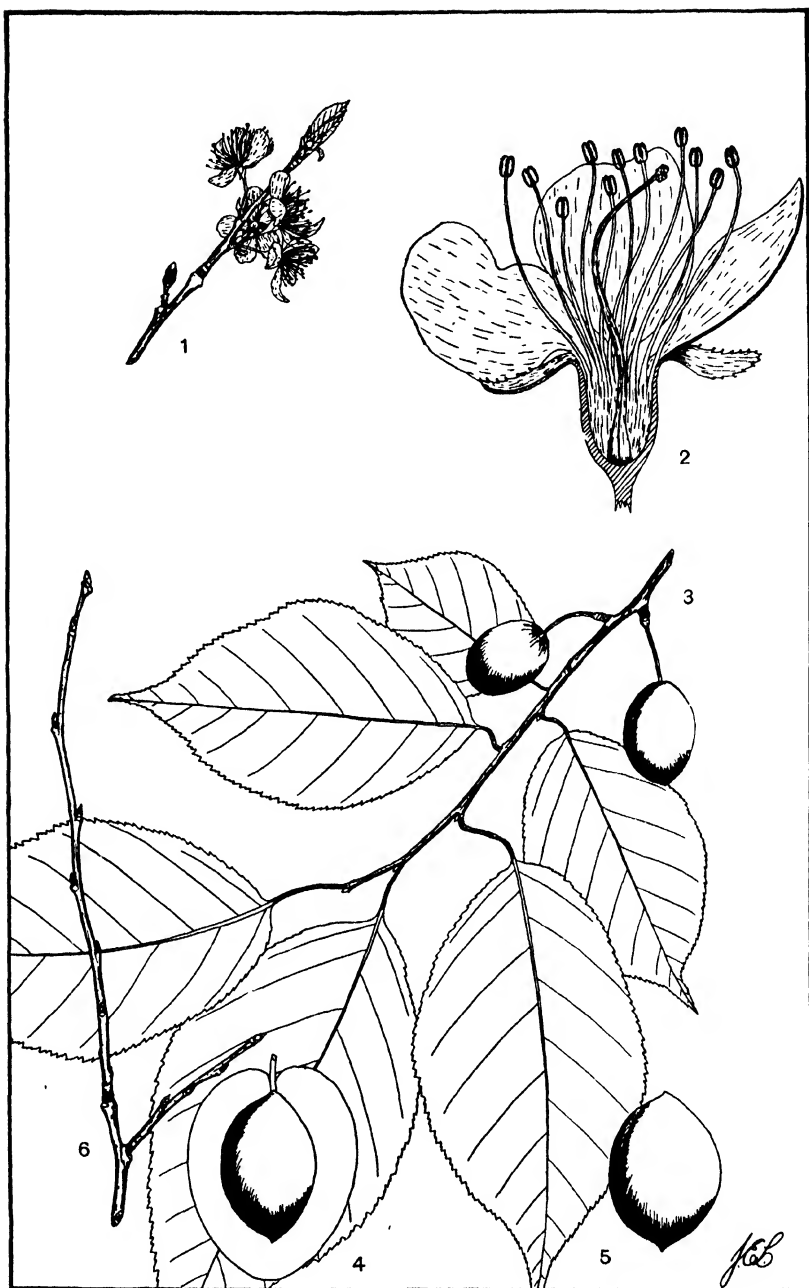
Fruit—A drupe, very variable in size, color, and shape (usually ovoid to oblong, rarely subglobose), ripening during August. It is commonly about an inch long, glaucous, and ranges in color from bluish black to violet or red. Flesh sweet. Stone free, large, nearly smooth, prominently grooved on one side.

Winter characters—Twigs rather stout, glabrous, reddish to grayish brown. Lateral spinulose spurs sometimes present. Terminal bud absent. Lateral buds ovate, acute, appressed, light brown, about ¼ of an inch long. Mature bark thin, grayish or brownish black, breaking up into large, thin, persisting plates.

Habitat—Prefers rich, moist soil but grown on a variety of sites about the habitations of man, along roads and fences, and on the borders of woods, often forming extensive thickets.

Range—Point of origin obscure but probably originally from the region of the Caucasus. It is held by some that *P. domestica* never existed in the wild form but is purely a horticultural species. Now widely cultivated in the Old and New World, often becoming an 'escape.'

Uses—Long cultivated in many forms for its fruit. Various ornamental varieties, including the double-flowered and variegated-leaved forms are propagated by nurserymen. Resembles the Wild Bullace Plum, *Prunus insititia* L., to which form it is held to revert by some authors but is distinct in possessing glabrous winter branchlets and usually unarmed branches, larger leaves, and larger fruit. The wood is hard, heavy, close-grained, reddish brown with pale sapwood. It is used abroad in cabinet work and for trinkets.



Canada Plum, Red Plum

Prunus nigra Ait. [*Prunus americana* var. *nigra* (Ait.) Waugh]

1. A twig showing flowers and leaf-buds $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 4$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times 1$
5. Stone, lateral view $\times 1$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE

Prunus nigra Ait. [*Prunus americana* var. *nigra* (Ait.) Waugh.]

Canada Plum, Red Plum

Habit—A shrub or occasionally a small, bushy tree 20–30 feet in height with a trunk diameter of 5–6 inches. Bole short, dividing 5–6 feet above the ground into a number of stout, ascending limbs to form a low-spreading, rounded top of many rigid, more or less contorted branches and zigzag twigs.

Leaves—Alternate, obovate to oblong-ovate and elliptic, $2\frac{1}{2}$ –4 inches long, $1\frac{1}{2}$ –3 inches wide, abruptly acuminate at the apex, rounded or broad-cuneate at the base, coarsely doubly crenate-serrate usually with small, dark-gland-tipped teeth, at maturity thin, firm, dull dark green and glabrous above, paler, somewhat pubescent and with prominent midrib beneath, borne on stout, usually biglandular petioles $\frac{1}{2}$ –1 inch long.

Flowers—Appearing in April or May before the leaves, perfect, $\frac{3}{4}$ –1 inch broad, borne on red pedicels $\frac{3}{4}$ – $\frac{1}{2}$ of an inch long in 3–5-flowered, lateral, glabrous umbels. Calyx-tube urn-shaped, dark red without, bright red within, 5-lobed, the lobes lanceolate, glandular-toothed, usually somewhat pubescent above, reflexed after anthesis. Petals 5, white fading to pink with age, orbicular-obovate, rounded and somewhat erose at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and small, oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style, and a broad, simple stigma.

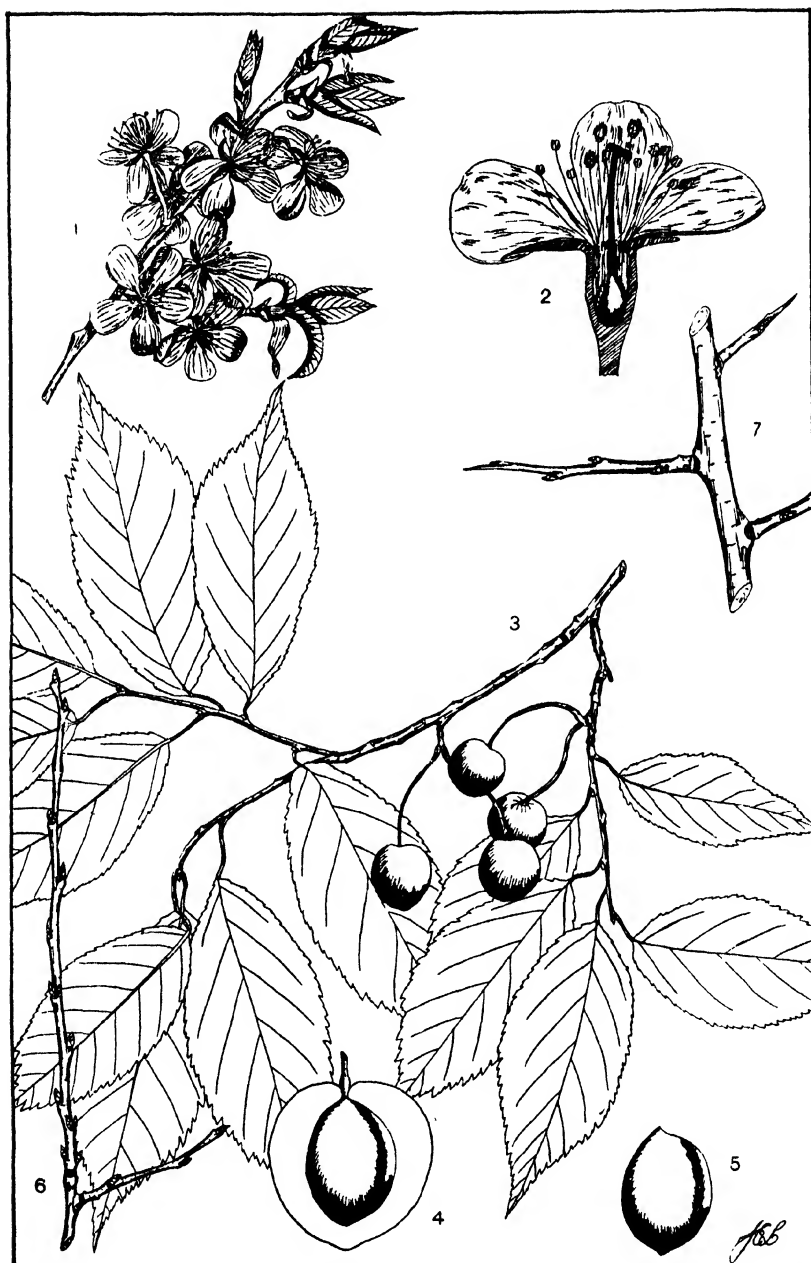
Fruit—An oblong-oval, slightly glaucous, thick-skinned, orange-red drupe, 1 – $1\frac{1}{4}$ inches long, ripening during the latter half of August. Flesh yellow, sour, adhering to the stone. Stone oval, thick-walled, compressed, slightly grooved on one side. Seed ovate, light brown, compressed.

Winter characters—Twigs rather stout, slightly zigzag, glabrous or somewhat puberulous, dark reddish brown and partly covered with a grayish, evanescent skin. Lateral spinescent spurs usually present. Terminal bud absent. Lateral buds conical, acute, chestnut-brown, about $\frac{1}{2}$ of an inch long. Mature bark thin, light grayish brown, at first smooth and marked with prominent, horizontally elongated lenticels, soon splitting and curling back in thick-layered plates exposing the darker, inner, scaly bark.

Habitat—A 'weed' tree preferring moist sites along fence rows, abandoned pastures, and in open glades and the margins of woods. Thrives on limestone outcrops.

Range—New Brunswick through southern Canada to Manitoba, southward into New England, central and western New York, Ohio, southern Michigan, Wisconsin, eastern Minnesota, and North Dakota.

Uses—Occasionally cultivated for its showy flowers in southern Canada and the Northeastern States. Blooming earlier and with more showy flowers than *Prunus americana* Marsh. Several varieties of cultivated plums have been derived from this species by horticulturists.



Wild Plum, Wild Yellow Plum

Prunus americana Marsh.

1. A twig showing flowers and leaf-buds x $\frac{1}{2}$
2. A flower, lateral sectional view x $1\frac{1}{2}$
3. A branch showing mature leaves and fruit x $\frac{1}{2}$
4. Fruit, lateral sectional view x $1\frac{1}{2}$
5. Stone, lateral view x $1\frac{1}{2}$
6. Winter twig x $\frac{1}{2}$
7. Portion of branch showing spinose twigs x $\frac{1}{2}$

ROSACEAE
***Prunus americana* Marsh.**

Wild Plum, Wild Yellow Plum

Habit—A shrub or occasionally a small tree 20—35 feet in height with a maximum trunk diameter of 12 inches. Trunk short, usually dividing 4—5 feet above the ground into many slender, spreading, slightly drooping branches which form a broad, rather deep crown.

Leaves—Alternate, narrowly obovate to elliptical, 2—4 inches long, $\frac{3}{4}$ —1½ inches wide, acuminate at the apex, broad-cuneate or rounded at the base, sharply and often doubly serrate, at maturity thick, firm, dark green and somewhat scabrous above, paler and glabrous or slightly pubescent along the midrib below, borne on slender, eglandular petioles $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—Appearing in April or May when the leaves are about one-third grown, perfect, about 1 inch broad, ill-scented, borne on slender pedicels $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long in 2—5-flowered, lateral, glabrous umbels. Calyx-tube narrow, urn-shaped, light red and glabrous or puberulous without, green within, 5-lobed, the lobes acuminate and reflexed after anthesis. Petals 5, white, obovate, rounded and irregularly erose at the top, with short red claws at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and small, oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style, and a broad, simple stigma.

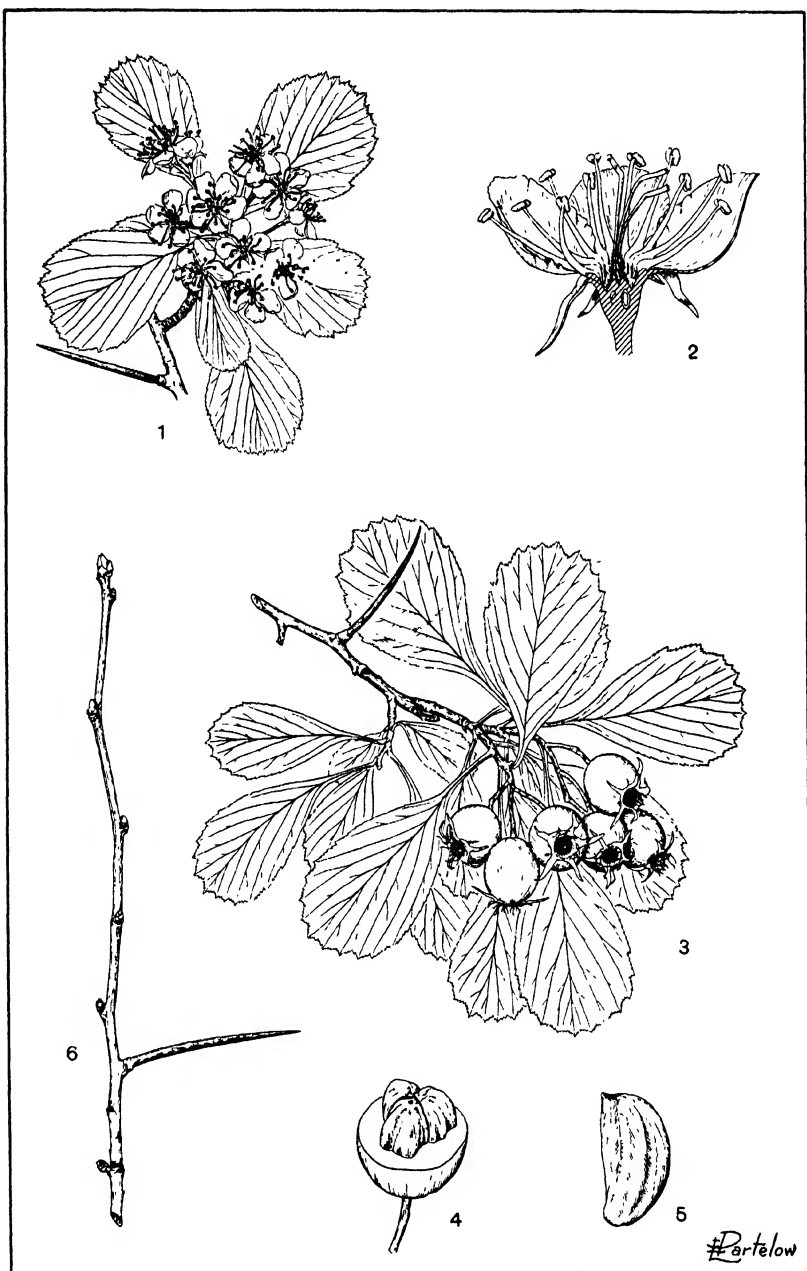
Fruit—A usually subglobose, glabrous, pale-punctate, thick-skinned, bright red or rarely yellowish drupe, $\frac{3}{4}$ —1 inch in diameter, maturing in late summer or early autumn. Flesh succulent, sour, adhering to the stone. Stone oval, compressed, thick-walled, slightly grooved on one side. Seed oval, light brown.

Winter characters—Twigs rather stout, glabrous, pale orange-brown, at length smooth and reddish brown. Lateral spinescent spurs usually present. Terminal bud absent. Lateral buds broadly conical, acute, brown, about $\frac{1}{2}$ of an inch long, the margins of the bud-scales ciliate. Mature bark thin, light reddish brown, breaking up into large, thin, persisting plates.

Habitat—Prefers rich soil in moist situations along stream courses, in hedge rows and fence corners, or the borders of swamps, often forming extensive thickets, more rarely on dry limestone outcrops.

Range—Massachusetts to Manitoba, south to Georgia, New Mexico, and Utah.

Uses—Not a timber species because of its diminutive size. Various varieties are cultivated ornamentally for their showy blossoms and bright green foliage, and for their fruit which has been greatly improved by selection. The tart fruit of the wild form is sometimes made into preserves. A number of hybrids are known.



Dotted Thorn, Large-fruited Thorn

Crataegus punctata Jacq.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit in section showing nutlets $\times 1$
5. Nutlet, lateral view $\times 2$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE
***Crataegus punctata* Jacq.**

Dotted Thorn, Large-fruited Thorn

Habit—A large shrub, or a small tree 20—30 feet in height with a trunk 4—8 inches in diameter and wide-spreading, horizontal, usually spiny branches which form a broad, rounded or flat-topped head.

Leaves—Alternate, wedge-obovate, 2—3 inches long, $\frac{3}{4}$ — $1\frac{1}{2}$ inches wide, rounded or short-pointed at the apex, contracted below into winged petioles $\frac{1}{2}$ —1 inch in length, irregularly doubly serrate above and those of the shoots often slightly lobed, entire or nearly so toward the base, at maturity thick, firm, pale green and glabrous on the upper surface with deeply impressed veins, villous beneath (especially on the prominent veins).

Flowers—Appearing in late May and early June when the leaves are about half grown, ill-scented, perfect, $\frac{3}{4}$ — $\frac{1}{2}$ ths of an inch broad, borne on stout, hairy pedicels in broad, leafy, thick-branched, many-flowered, villous corymbs. Calyx-tube narrowly obconic, villous, 5-lobed, the lobes narrow, acute, entire or minutely glandular-serrate, at length deflexed. Petals 5, white, obovate, rounded and somewhat wavy-margined above, contracted at the base, inserted on the calyx-tube. Stamens 20, with elongated filaments and white to rose-colored anthers. Ovary inferior, 2—5-celled. Styles 2—5 (generally 3), surmounted at the base by a ring of tomentum. Stigmas capitate, terminal.

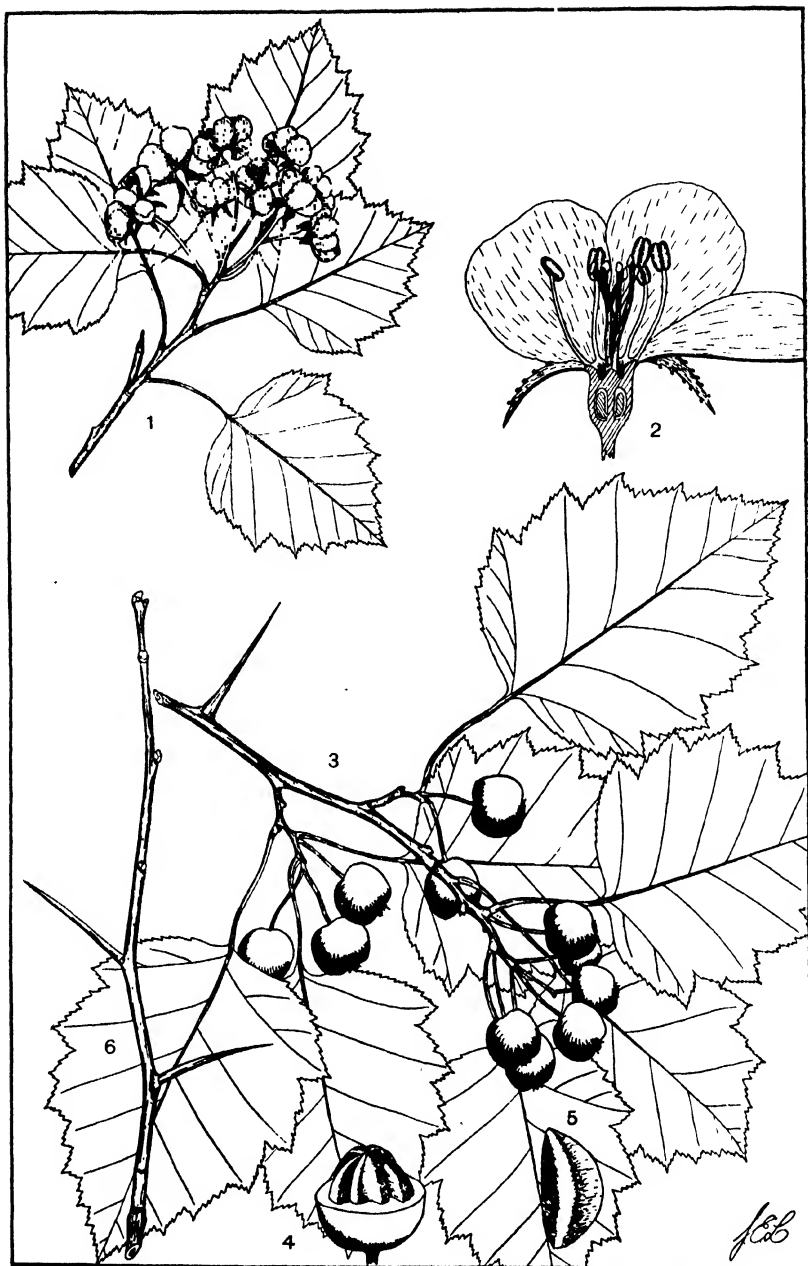
Fruit—A pyriform or subglobose, dull red or bright yellow pome, $\frac{3}{4}$ th—1 inch long, dotted with numerous, small, white spots, marked at the apex by the persisting calyx-lobes and stamen-filaments, borne on slender pedicels in lax, few-fruited, corymbose clusters, ripening in early autumn. Flesh thin, dry, mealy, enclosing 2—5 (generally 3), 1-seeded, bony nutlets which are rounded and vertically grooved on the back.

Winter characters—Twigs rather stout, somewhat zigzag, smooth, more or less lustrous, light orange-brown, at length becoming ashy-gray, armed with slender, straight, light orange-brown or gray spines 2—3 inches long. Buds divergent, globose, chestnut- to olive-brown, smooth, somewhat lustrous, about $\frac{1}{8}$ th of an inch in diameter. Mature bark grayish white, scaly on the surface, thin.

Habitat—On moist, often rocky sites in open woods and upland pastures, often forming extensive thickets and frequently associated with other species of *Crataegus*.

Range—Quebec westward to northern Illinois, southeastern Minnesota, and Iowa, southward through western New England to Pennsylvania, and along the mountains to northern Georgia.

Uses—A 'weed' tree but occasionally cultivated as an ornamental. Especially beautiful in autumn because of its showy, red or yellow fruit.



Scarlet Haw, Red Haw

Crataegus pedicellata Sarg. [*Crataegus coccinea* L., in part]

- | | |
|---|--|
| 1. A twig showing flowers and immature leaves x $\frac{1}{2}$ | 4. Fruit in section showing nutlets x $1\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 2 | 5. Nutlet, lateral surface view x 2 |
| 3. A branch showing mature leaves and fruit x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Crataegus pedicellata Sarg. [*Crataegus coccinea* L., in part]

Scarlet Haw, Red Haw

Habit—A small tree 18—20 feet in height, with a trunk diameter of 6—12 inches and many slender, elongated, ascending or spreading branches which form a rounded, symmetrical, dense crown.

Leaves—Alternate, broadly ovate or sometimes obovate, 3—4 inches long, 2—3 inches wide, acute or acuminate at the apex, broadly cuneate or truncate at the base, divided above the middle in 4 or 5 pairs of short, pointed, divergent lobes, doubly serrate on the margin except toward the base, at maturity thin, dark green and scabrous above, paler and nearly glabrous below, borne on slender, glandular petioles $1\frac{1}{2}$ — $2\frac{1}{2}$ inches long.

Flowers—Appearing in late May and early June when the leaves are about half grown, ill-scented, perfect, $\frac{3}{4}$ — $\frac{1}{2}$ of an inch broad, borne on long, slender pedicels in loose, lax, many-flowered, somewhat villose corymbs. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes broad, acute, coarsely glandular-serrate, at length reflexed. Petals 5, white, obovate, rounded at the apex, contracted at the base, entire, inserted on the calyx-tube. Stamens usually 10, with elongated filaments and rose-colored anthers. Ovary inferior, 5-celled. Styles 5, surrounded at the base by a ring of tomentum. Stigmas capitate, terminal.

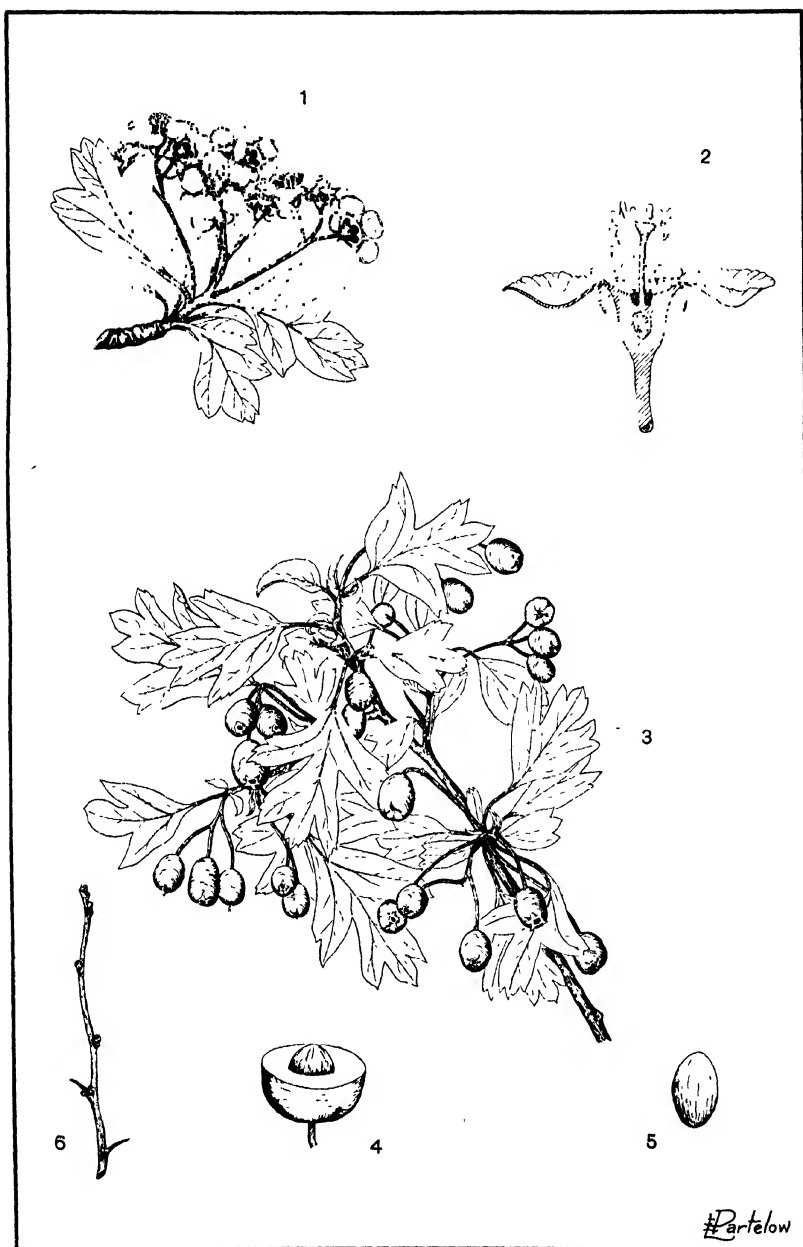
Fruit—A pyriform or ellipsoidal, lustrous, dark-punctate, bright scarlet pome, $\frac{3}{4}$ — $\frac{1}{2}$ of an inch long, marked at the apex by the persisting calyx-lobes and stamen-filaments, borne on slender pedicels in lax, few-fruited, glabrous, corymbose clusters, deciduous in early autumn. Flesh thin, dry, mealy, enclosing 5, rounded, vertically-grooved, 1-seeded, bony nutlets.

Winter characters—Twig slender, somewhat zigzag, smooth, dark chestnut-brown and lustrous, becoming light gray the second season, armed with straight or slightly curved, lustrous spines $1\frac{1}{2}$ —2 inches long. Buds globose, bright red, about $\frac{1}{8}$ of an inch in diameter. Mature bark thin, close, reddish brown, scaly on the surface.

Habitat—A 'weed' tree occurring in waste places along fence rows, in fence corners, old pastures, and open upland woods.

Range—Northeastern United States but imperfectly known. Said to range from Connecticut into Pennsylvania, New York, and Ontario.

Uses—Of no importance except as an ornamental. A tree 'weed.' Occasionally grown in arboretums.



Hawthorn

Crataegus monogyna Jacq. [*Crataegus oxyacantha* var. *monogyna* (Jacq.) Loud.]

- | | |
|---|--|
| 1. A twig showing flowers and immature leaves x $\frac{1}{2}$ | 4. Fruit in section showing solitary nutlet x $1\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 2 | 5. Nutlet, lateral surface view x $1\frac{1}{2}$ |
| 3. A branch showing mature leaves and fruit x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Crataegus monogyna Jacq. [*Crataegus oxyacantha* var. *monogyna* (Jacq.) Loud.]

Hawthorn

Habit—A spiny shrub, or a small tree 20 to 30 feet in height with a short trunk breaking up into a number of ascending limbs and spreading branches which support a wide, globose, bushy crown. Spur-shoots numerous.

Leaves—Deciduous, alternate, broadly ovate or obovate, stipulate, $\frac{3}{4}$ ths— $2\frac{1}{4}$ inches long, $\frac{1}{2}$ to 2 inches broad, divided toward the apex into 3—5 narrow, acute lobes provided with a few teeth near the tip, cuneate at the base, semi-coriaceous, glabrous, dark green above, paler below, borne on rather slender petioles $\frac{1}{4}$ — $\frac{3}{8}$ ths of an inch in length.

Flowers—Appearing in May or June when the leaves are about two-thirds grown, perfect, about $\frac{3}{4}$ ths of an inch in diameter, on long, slender, glabrous or hairy pedicels in 5—12-flowered corymbs. Calyx glabrous or hairy; calyx-tube urn-shaped, 5-lobed, the lobes broad, obtuse, about one-third the length of the tube. Petals 5, white or pink, broadly oval to nearly orbicular, rounded at the apex, abruptly contracted into a claw at the base, entire, concave and the upper margin sometimes slightly reflexed, inserted on the calyx-tube. Stamens 20, with elongated filaments and red anthers. Ovary inferior, 1- (rarely 2) celled, Style 1 (rarely 2), surrounded at the base by a ring of tomentum. Stigma capitate, terminal.

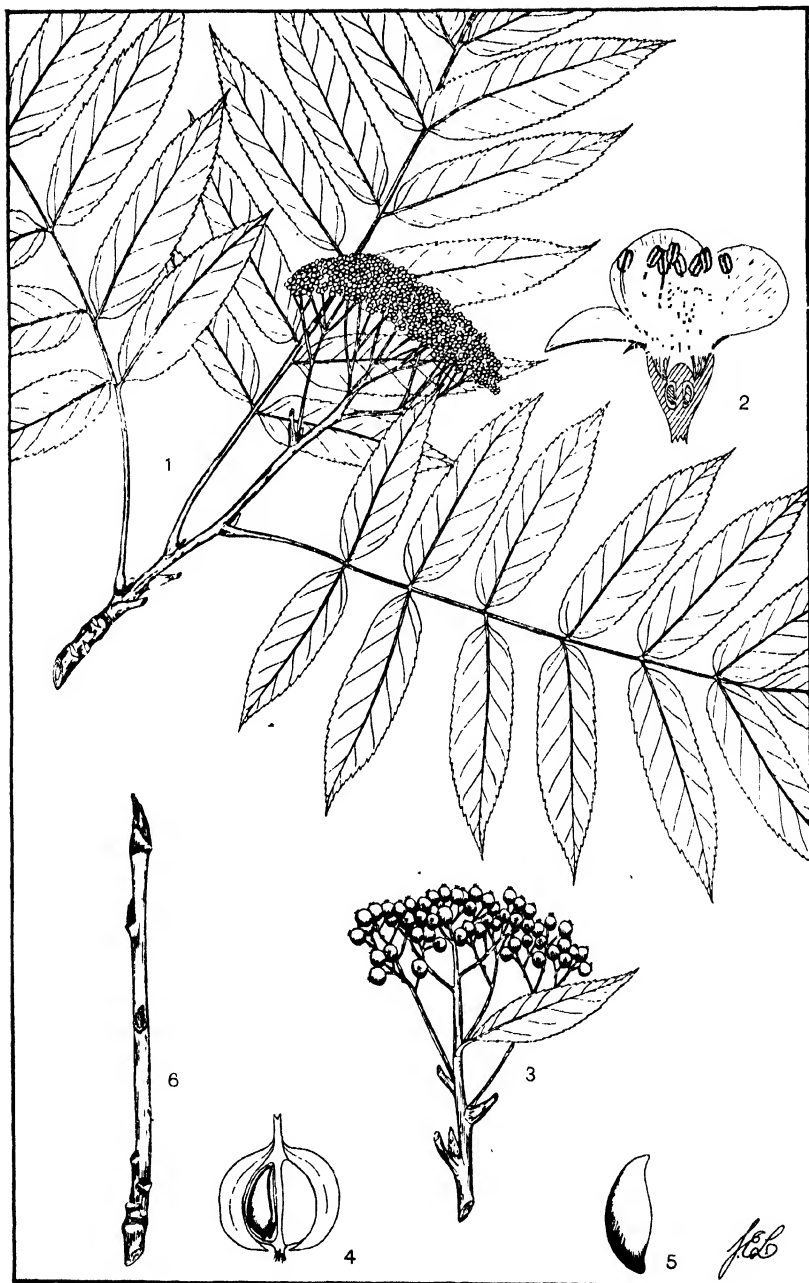
Fruit—An ellipsoid, lustrous, dark-punctate, bright scarlet, 1-stoned pome, $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long, marked at the apex by the persisting calyx-lobes and stamen-filaments, borne on slender pedicels in lax, few-fruited, glabrous, corymbose clusters. Fruit-stalks and some fruits often persisting on the twigs for some time after normal fruit fall. Flesh thick, dry and mealy; nutlet ellipsoid, vertically grooved, 1-seeded.

Winter characters—Twigs slender, somewhat zigzag, smooth, more or less lustrous, chestnut-brown above and light olive-brown below, becoming light brownish gray the second season, usually armed at the nodes toward the base of the growth of the season with straight or nearly straight, lustrous spines $\frac{1}{4}$ — $\frac{3}{8}$ ths of an inch long. Buds strongly divergent, globose, chestnut-brown, smooth, somewhat lustrous, about $\frac{3}{32}$ ds of an inch in diameter. Mature bark blackish gray, finely scaly on the surface, thin. Sucker-shoots common.

Habitat—Thrives on a variety of soils along hedge rows, in old pastures, and on abandoned lands where brush is permitted to grow. Difficult to eradicate when once well established.

Range—Native to Europe, northern Africa and western Asia, and long cultivated. Naturalized in the Northeastern States, spreading through the agency of birds.

Uses—Under cultivation a desirable ornamental species, especially some of its varieties. The wild form is of little value except as providing food for birds.



Mountain Ash, American Mountain Ash

Sorbus americana Marsh. [*Pyrus americana* (Marsh.) DC.]

- | | |
|--|---|
| 1. A branch showing inflorescence and mature leaves $\times \frac{1}{2}$ | 4. Fruit, lateral sectional view $\times 3$ |
| 2. A flower, lateral sectional view $\times 5$ | 5. Seed, lateral view $\times 5$ |
| 3. A fruit cluster, lateral view $\times \frac{1}{2}$ | 6. Winter twig $\times \frac{1}{2}$ |

ROSACEAE

Sorbus americana Marsh. [*Pyrus americana* (Marsh.) DC.]

Mountain Ash, American Mountain Ash

Habit—A small tree 20—30 feet in height with a trunk diameter of 4—12 inches, often a shrub with numerous stems, spreading by means of root-suckers. Trunk short, breaking up a few feet above the ground into spreading, slender branches to form a narrow, round-topped head. Fairly tolerant in youth, less so in age.

Leaves—Alternate, odd-pinnately compound, 6—8 inches long, consisting of 13—17 sessile or nearly sessile leaflets arranged in pairs along a slender rachis, the terminal leaflet stalked. Leaflets lance-oblong to lanceolate, acuminate at the apex, rounded or cuneate and inequilateral at the base, serrate, 2—4 inches long, $\frac{1}{4}$ — $\frac{3}{4}$ of an inch broad, at maturity thin, glabrous and dark yellowish green above, paler and rarely pubescent below.

Flowers—Appearing during May and June after the leaves are fully grown, perfect, about $\frac{1}{4}$ of an inch in diameter, borne on short, stout pedicels in flat, compound cymes 3—4 inches in diameter. Calyx gamosepalous, obconic, puberulous, 5-lobed, the lobes short, triangular, and tipped with minute glands. Petals 5, white, orbicular, short-clawed, inserted with the stamens on the calyx-tube. Stamens about 20, exserted, with purplish anthers. Pistil consisting of a 3-celled, inferior ovary surmounted by 3 distinct styles with capitate stigmas.

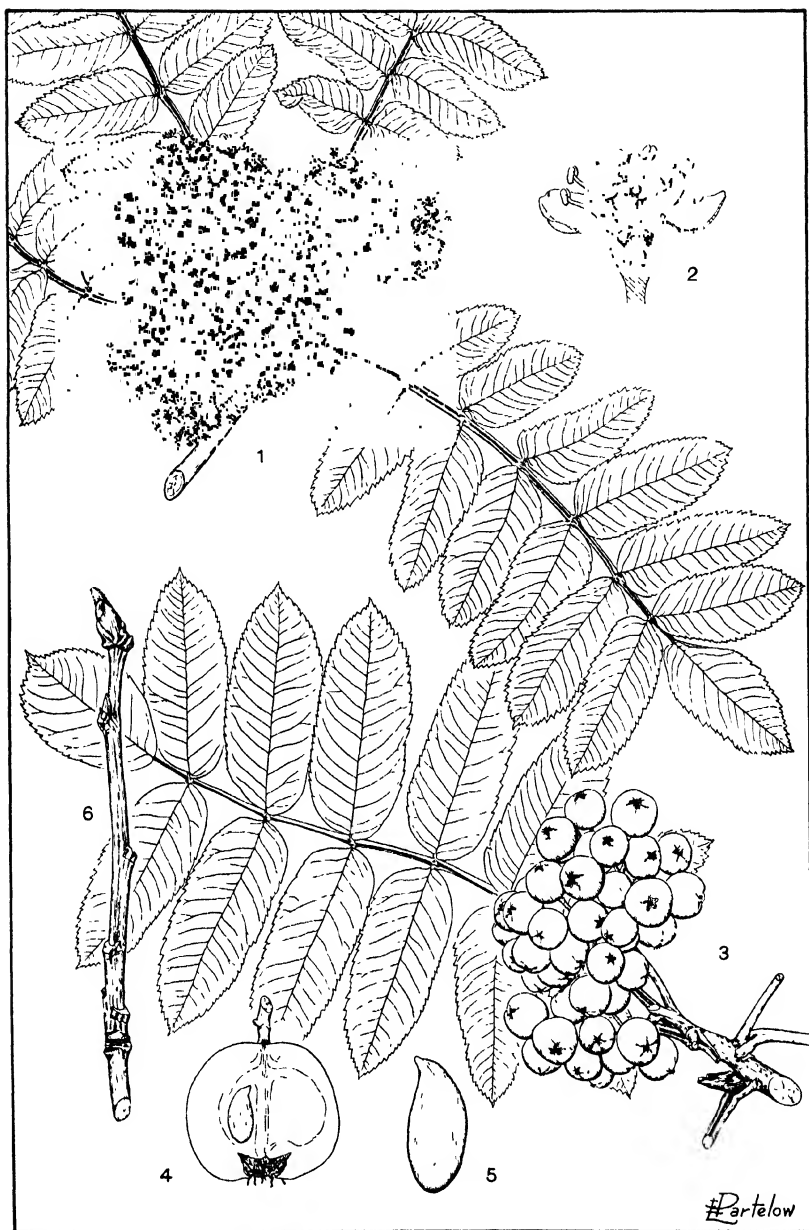
Fruit—A stalked, globose, berry-like, bright red pome, about $\frac{1}{4}$ of an inch in diameter, marked at the top by the persistent calyx-lobes, ripening in the autumn and persisting until the following spring unless devoured by birds. Flesh thin, acrid. Seeds light chestnut-brown, about $\frac{1}{8}$ of an inch long.

Winter characters—Twigs rather stout, glabrous, somewhat glaucous, grayish to reddish brown, at length dark brown. Terminal bud ovate to broadly conical, somewhat curved, gummy and somewhat pilose without, dense-woolly within, dark purplish red, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. Lateral buds smaller, somewhat flattened and closely appressed. Mature bark thin, light gray, smooth or somewhat scaly.

Habitat—Prefers open, moist sites along lake shores, mountain streams, the margins of peat bogs, and in damp woods, but thrives in drier situations on the thin soils of ledges and rocky hillsides.

Range—Newfoundland to Manitoba, south through Quebec, Ontario, and the Great Lakes region to Minnesota and Michigan, at high elevations in northeastern United States, southward in the Appalachians to eastern Tennessee and western North Carolina.

Uses—Of no commercial importance. The tree has ornamental value and is occasionally cultivated in the Northeastern States and southern Canada. The inner bark and fruit possess some medicinal qualities.



Northern Mountain Ash

***Sorbus decora* Schneid. [*Sorbus americana* var. *decora* (Sarg.) Sarg.;
Pyrus americana var. *decora* Sarg.; *Pyrus sitchensis* Rab. et Fern.,
 not (Roem.) Piper.]**

1. A branch showing inflorescence and mature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2\frac{1}{2}$
3. Portion of a branch showing a fruit cluster and one mature leaf $\times \frac{1}{4}$
4. Fruit, lateral sectional view $\times 2$
5. Seed, lateral view $\times 5$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE

Sorbus decora Schneid.*[**Sorbus americana** var. **decora** (Sarg.) Sarg.;
Pyrus americana var. **decora** Sarg.; **Pyrus sitchensis** Rab. et Fern.,
not (Roem.) Piper.]

Northern Mountain Ash

Habit—A small tree occasionally 35 feet high with a trunk sometimes a foot in diameter and wide-spreading branches which form a round-topped, handsome head, often shrubby and branching close to the ground.

Leaves—Alternate, odd-pinnately compound, 5–10 inches long, consisting of 9–15 (mostly 13), sessile or nearly sessile leaflets arranged in pairs along a stout, glabrous or sparingly villous, grooved rachis, the terminal leaflet stalked. Leaflets elliptic-oblong, rather blunt, rounded and inequilateral at the base, sharply and often somewhat doubly serrate to near the base with spreading teeth, 1–2½ inches long, ½–1 inch broad, at maturity bright green and glabrous above, paler and glabrous or sparingly villose beneath.

Flowers—Appearing in June after the leaves are fully grown, ill-scented, perfect, about ⅓ths of an inch in diameter, borne on short pedicels in compact, subglabrous cymes 3–6 inches in diameter. Calyx gamosepalous, obconic, essentially glabrous, with short, acute lobes which are frequently glandular along the margins. Petals 5, white, orbicular, concave, short-clawed, inserted with the stamens on the calyx-tube, at length reflexed. Stamens usually 20, as long as the petals, with pale yellow anthers, exserted. Pistil 4-celled, with a like number of distinct styles and capitate, orange stigmas.

Fruit—A stalked, globose, berry-like, bright red pome, ⅓–⅔ths of an inch in diameter, marked at the top by the persistent calyx-lobes, ripening in the autumn and persisting after the leaves have fallen.

Winter characters—Twigs rather stout, glabrous, grayish brown, at length dark brown. Terminal bud ovate, glutinous, dark purplish red, ½–¾ of an inch long. Lateral buds smaller, somewhat flattened, closely appressed. Mature bark thin, dark gray, smooth or somewhat scaly.

Habitat—Like the preceding species, a moisture-loving species occurring along lake shores, mountain streams, and on springy rocky sites where an abundance of moisture is assured.

Range—Labrador to Minnesota, southward in the mountains to northern New Hampshire, Vermont, and New York. The form described as **Sorbus dumosa** Greene is apparently naturalized on high hills near Caroline Center, New York.

Uses—Not a timber tree. This **Sorbus** is probably the most beautiful member of the genus and is deserving of more consideration as an ornamental. The foliage is handsomer than that of American Mountain Ash, the flowers and flower-clusters are larger and more showy, and the fruits are larger, more brilliant in color, and hence more conspicuous.

***Sorbus dumosa** Greene, a closely allied form, is considered to be a separate species by some authors, as identical by others. **Sorbus decora** is said to have larger fruits and **Sorbus dumosa** fewer leaflets with sharper teeth, but apparently these two forms intergrade.



European Mountain Ash, Rowan Tree

Sorbus aucuparia L. [*Pyrus aucuparia* (L.) Gaertn.]

- | | |
|---|--|
| 1. A branch showing inflorescence and mature leaves x $\frac{1}{2}$ | 3. A fruit cluster, lateral view x $\frac{1}{2}$ |
| 2. A flower, lateral sectional view x $2\frac{1}{2}$ | 4. Fruit, lateral sectional view x 2 |
| | 5. Seed, lateral view x 3 |
| | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Sorbus aucuparia L. [*Pyrus aucuparia* (L.) Gaertn.]

European Mountain Ash, Rowan Tree

Habit—A small, quick-growing tree, usually 20—50 feet in height with a trunk diameter of 6—15 inches, under optimum conditions occasionally 60 feet tall, at the northern limits of its range in Eurasia often reduced to a small shrub. Trunk short, separating a few feet above the ground into stout, spreading branches to form a rounded crown.

Leaves—Alternate, odd-pinnately compound, 6—10 inches long, consisting of 9—15 sessile or nearly sessile leaflets arranged in pairs along a slender hairy rachis, the terminal leaflet stalked. Leaflets elliptic-oblong, blunt or short-pointed at the apex, rounded and inequilateral at the base, serrate above (the lower third entire), $\frac{3}{4}$ —2 inches long, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch broad, at maturity dull green and somewhat pubescent above, glaucescent and pubescent beneath.

Flowers—Appearing in June or July after the leaves are fully grown, perfect, about $\frac{1}{2}$ of an inch in diameter, borne on short pedicles in compact, woolly cymes 4—6 inches in diameter. Calyx gamosepalous, obconic, with short, acute, pubescent lobes. Petals 5, white, orbicular, short-clawed, inserted with the stamens on the calyx-tube. Stamens about 20, as long as the petals. Pistil 3—5-celled, with a like number of distinct styles and capitate stigmas.

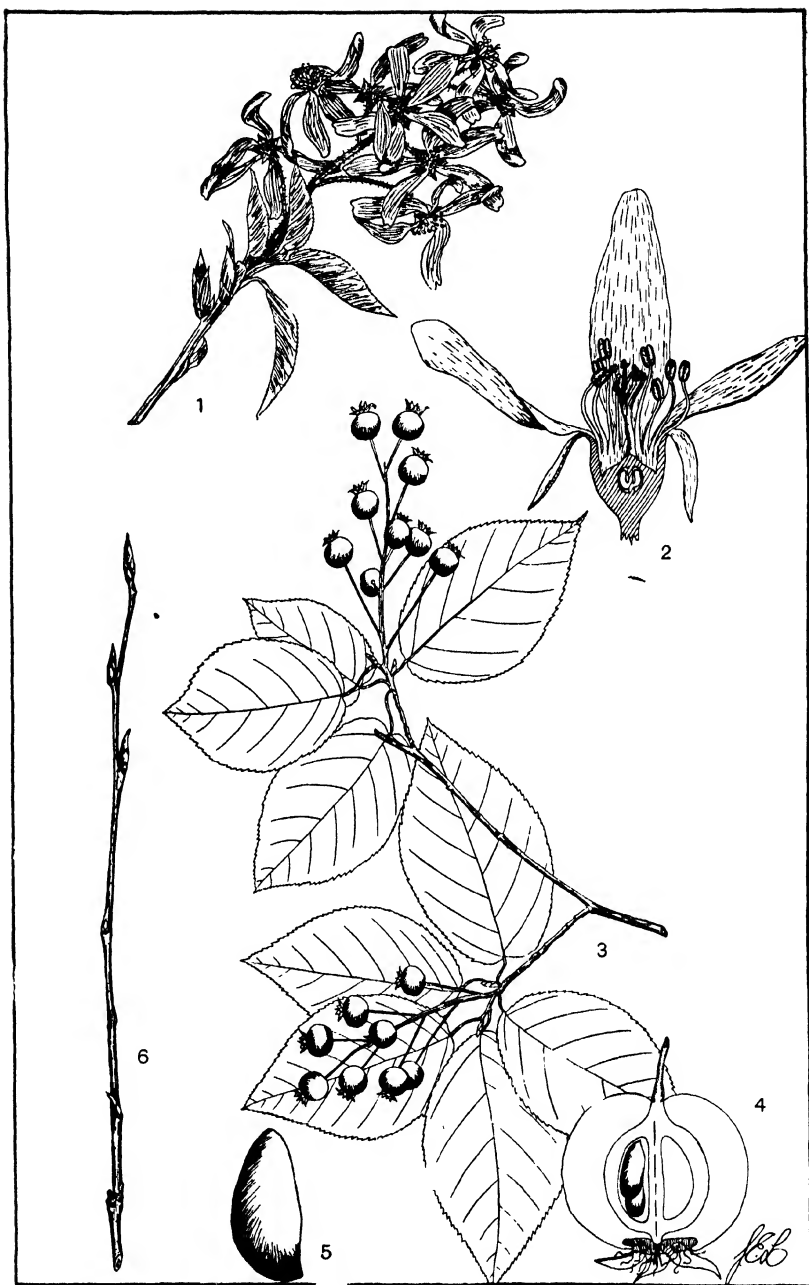
Fruit—A stalked, globose, berry-like, bright red pome, about $\frac{1}{2}$ of an inch in diameter, marked at the top by the persistent calyx-lobes, ripening in the autumn and persisting into the winter unless devoured by birds. Seeds chestnut-brown, about $\frac{1}{8}$ of an inch long.

Winter characters—Twigs rather stout, pubescent, grayish brown, at length dark brown. Terminal bud ovate, white-villous-tomentose, dark purplish red, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. Lateral buds smaller, somewhat flattened, closely appressed. Mature bark thin, dark gray, smooth or somewhat scaly.

Habitat—Widely planted in the Northeastern States around the habitations of man as a shade and ornamental tree. The fruit is devoured by birds and wild trees thus sown are occasionally found along fences, in upland bogs, and around the borders of swamps.

Range—Through northern Europe to Western Asia and Siberia. Naturalized in the Northeastern States and eastern Canada.

Uses—Chiefly an ornamental species because of its showy white flowers and large clusters of bright red fruit which persist into the late fall and winter. Grown widely in the United States as a park tree, especially the various horticultural varieties. Wood hard, heavy, close-grained, light brown with paler sapwood. Used occasionally in the Old World for tool handles, agricultural implements, etc.



Shad Bush, Serviceberry, Juneberry

Amelanchier canadensis (L.) Med.

- | | |
|---|---|
| 1. A twig showing flowers and immature leaves x 1 | 4. Fruit, lateral sectional view x $2\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 4 | 5. Seed, lateral view x 5 |
| 3. Branch showing mature leaves and fruit x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Amelanchier canadensis (L.) Med.*

Shad Bush, Serviceberry, Juneberry

Habit—A small tree 20—30 feet in height with a trunk diameter of 6—12 inches, occasionally under optimum conditions 50 feet tall, at times shrubby and fastigiately branched. Trunk long, slender, usually straight and with slight taper. Crown narrow, oblong, round-topped, dense with many slender branches.

Leaves—Alternate, generally obovate, less commonly ovate, oval, or oblong, $1\frac{1}{2}$ —4 inches long, $\frac{3}{4}$ —2 inches wide, acute or acuminate at the apex, cordate or rounded at the base, sharply and somewhat doubly serrate, silvery white-tomentose when young, at maturity glabrous or nearly so, dull yellowish green above, paler and slightly pubescent on the veins beneath, borne on slender petioles $\frac{1}{2}$ —1 inch long.

Flowers—Appearing in April and May when the leaves are very small and not unfolded or still enclosed within the bud-scales, perfect, $\frac{1}{2}$ —1 inch broad, borne on slender bibracteolate pedicels $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long in dense, nodding tomentose racemes $1\frac{1}{2}$ —2 inches long. Calyx-tube campanulate, quite smooth, 5-lobed, the lobes oblong-triangular, acute or obtuse, tomentose at least above, reflexed in fruit. Petals white, linear-oblong or linear, rounded or obtuse at the apex, inserted on the calyx-tube, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. Stamens usually 20, shorter than the petals, the subulate filaments bearing oblong, yellow anthers. Ovary smooth, inferior, 5-celled. Styles 3—5, connate below, bearing terminal stigmas.

Fruit—A globose, berry-like, glaucous, maroon-purple, falsely 10-celled pome, about $\frac{1}{4}$ of an inch in diameter, marked at the apex by the persistent calyx-lobes and stamen-filaments, borne on slender pedicels $\frac{1}{2}$ —1 inch long, ripening in June or July. Flesh dry, rather tasteless. Seeds 10 or less, small.

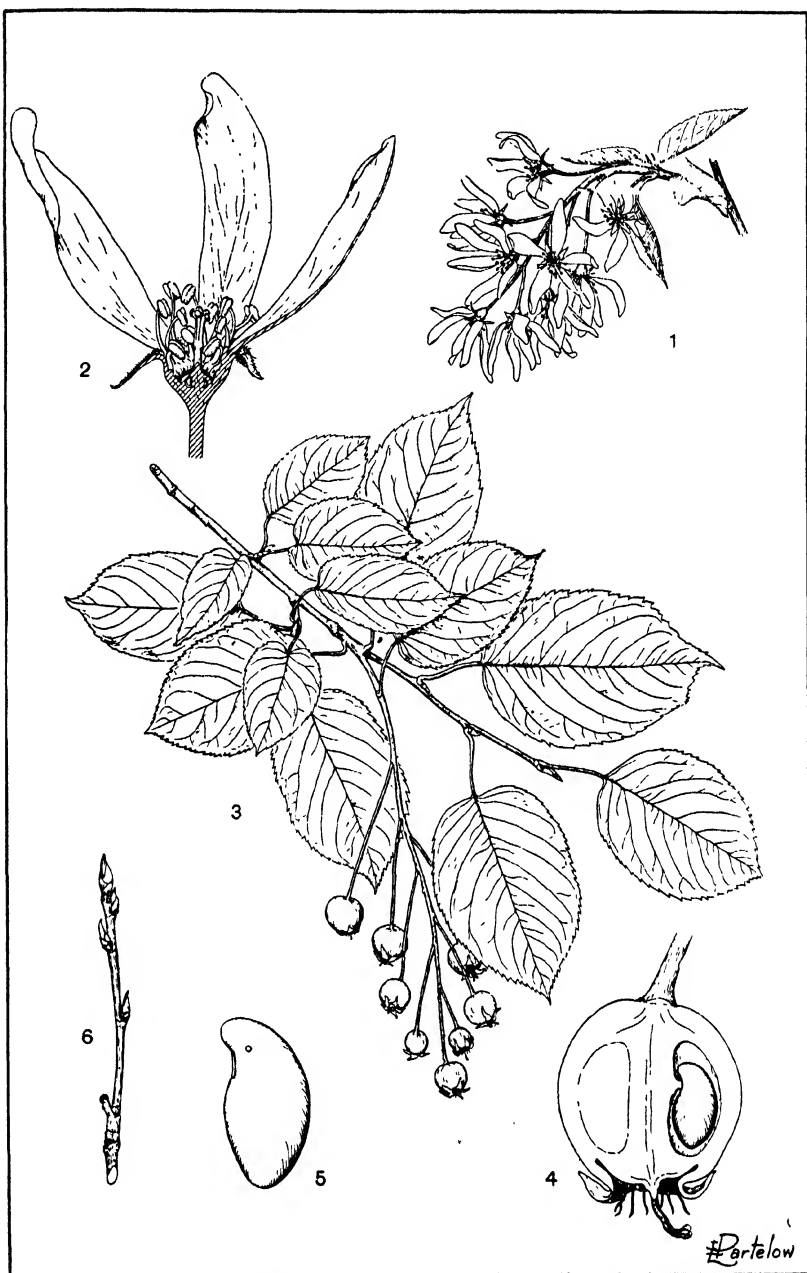
Winter characters—Twigs slender, somewhat zigzag, smooth but usually covered with a thin, grayish, evanescent outer layer, reddish brown with small minute lenticels, at length dark reddish brown. Terminal bud narrowly ovate to conical, acuminate, greenish or purplish brown, hairy at the apex and along the scale-margins, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long. Lateral buds on vigorous twigs normal, smaller than the terminal bud, somewhat divergent. On slow-growing twigs the lateral buds are often rudimentary. Mature bark thin, smooth, grayish brown, on older trees divided by shallow fissures into narrow, scaly, longitudinal ridges.

Habitat—Dry rocky crests and hillsides, open upland woods, and limestone ridges, seemingly preferring calcareous soils.

Range—Maine to Georgia and Louisiana, west to Iowa and Missouri.

Uses—Not a timber species because of its small size. Wood hard, heavy, strong, close-grained, dark brown often tinged with red, with thick, paler sapwood. Frequently with brown streaks, the occluded mines of cambial miners. Occasionally used for tool handles and in the manufacture of fishrods. The showy white flowers which appear in dense masses in early spring before the leaves have become green, render this species of ornamental value. The fruit is a favorite food of birds.

*X *A. grandiflora* Rehd. is a hybrid between this species and *A. laevis* Wieg., which is described on the next page.



Smooth Northern Shadbush, Smooth Service-berry

Amelanchier laevis Wieg. [*Amelanchier canadensis* Gray in part, not Med.]

- | | |
|---|---|
| 1. A twig showing flowers and immature leaves x $\frac{1}{2}$ | 4. Fruit, lateral sectional view x $2\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 2 | 5. Seed, lateral view x 5 |
| 3. Branch showing mature leaves and fruit, x $\frac{1}{2}$ | 6. Winter twig x $\frac{1}{2}$ |

ROSACEAE

Amelanchier laevis Wieg.* [*Amelanchier canadensis* Gray in part, not Med.]

Smooth Northern Shadbush, Smooth Service-berry

Habit—A small tree attaining a maximum height of 30—40 feet with a trunk diameter of 8—14 inches, usually much smaller and often shrubby in the northern portion of its range. Crown narrow, round-topped, composed of spreading branches.

Leaves—Alternate, ovate-oval to oval and ovate-oblong, rarely slightly obovate or elliptical, $1\frac{1}{2}$ —2 $\frac{1}{2}$ inches long, $1\frac{1}{4}$ —1 $\frac{3}{4}$ inches wide, short-acuminate at the apex, subcordate, rounded or more rarely acute at the base, sharply serrate nearly to the base with firm, callous-tipped, medium-sized teeth, essentially glabrous from the first, livid-glaucous-purple at flowering time, at length dark green and slightly glaucous above, somewhat paler beneath, borne on slender, glabrous petioles $\frac{1}{2}$ —1 inch long.

Flowers—Appearing in April and May when the leaves are one-half to three-fourths grown (usually flowering in advance of *A. canadensis* (L.) Medic.), perfect, $\frac{3}{4}$ —1 $\frac{1}{4}$ inches broad, borne on long, slender, bracteolate pedicels (lowest pedicels $\frac{3}{4}$ ths—1 $\frac{1}{2}$ inches in length) in loose, flexuous, drooping, glabrous, many-flowered racemes $1\frac{1}{2}$ —2 $\frac{3}{4}$ ths inches long. Calyx-tube campanulate, glabrous, 5-lobed, the lobes triangular-lanceolate or subulate, generally becoming abruptly reflexed at the base when the petals fall. Petals white, linear-oblong, rounded or obtuse at the apex, inserted on the calyx-tube, $\frac{3}{4}$ ths— $\frac{1}{2}$ ths of an inch long. Stamens usually 20, much shorter than the petals, with subulate filaments and oblong, yellow anthers. Ovary smooth at the summit, inferior, 5-celled. Styles 3—5, connate below, bearing terminal stigmas.

Fruit—A globose, berry-like, glaucous, purple or nearly black, falsely 10-celled pome, about $\frac{1}{3}$ rd of an inch in diameter, marked at the apex by the persistent calyx-lobes and stamen-filaments, borne on slender pedicels 1—2 inches long, ripening in late June or early July. Flesh dark, juicy, sweet, edible. Seeds one to each cell, small.

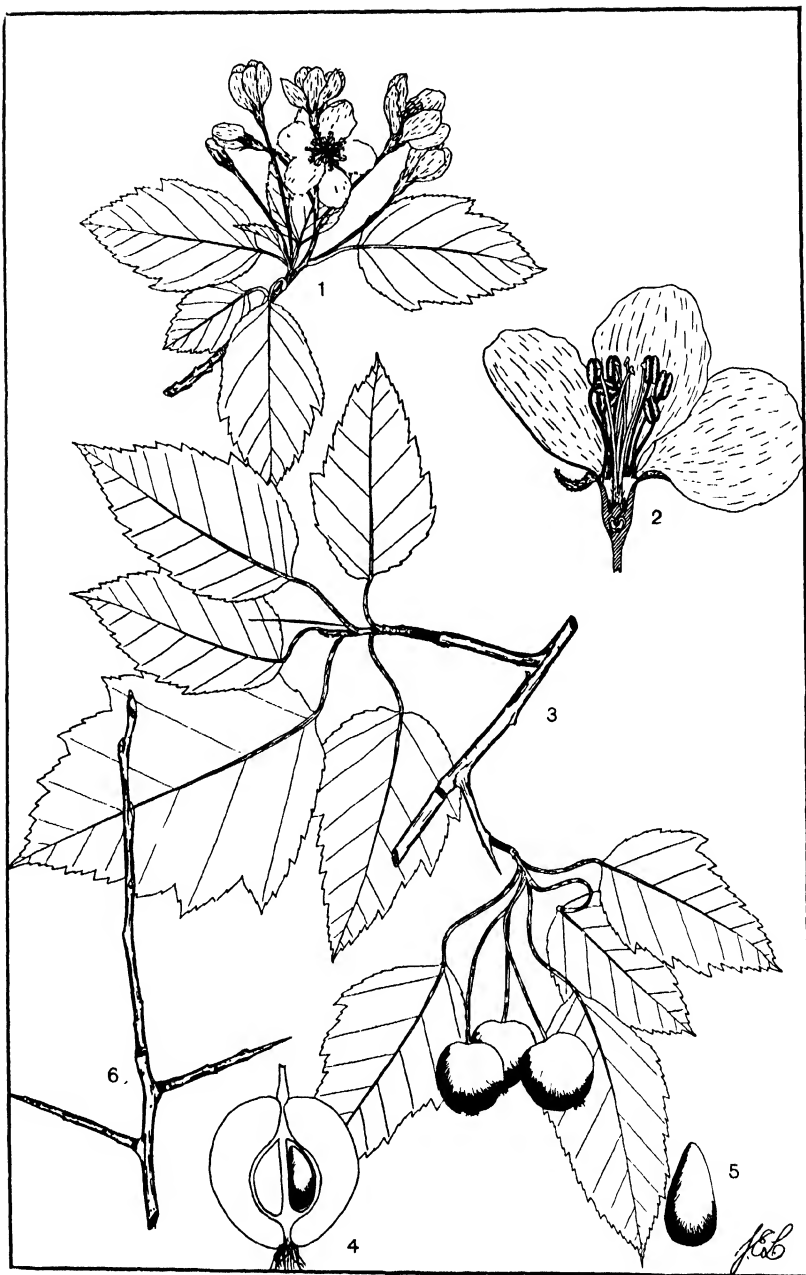
Winter characters—Twigs slender, somewhat zigzag, smooth, brownish red splotched with gray (areas covered by a thin, grayish, evanescent skin), somewhat lustrous (except the grayish splotches), at length blackish gray. Terminal bud narrowly ovate to conical, acuminate, purplish brown, smooth or slightly hairy at the apex and along the margins of the upper scales, $\frac{3}{8}$ — $\frac{1}{2}$ of an inch long. Lateral buds on vigorous shoots somewhat smaller than the terminal bud, slightly divergent, often rudimentary on slow-growing shoots. Mature bark thin, smooth, blackish gray.

Habitat—Damp or rather dry woodlands and thickets, usually on more acid soils than *Amelanchier canadensis* (L.) Medic. In New York State, frequently occurring around the margins of cold swamps and peat bogs, along mountain streams, and on the south slopes of east-west-running glens.

Range—Newfoundland, New England to Michigan, southward to Georgia, Alabama, and Kansas. Rare on the southern coastal plain.

Uses—More ornamental than *Amelanchier canadensis* (L.) Medic., with handsomer foliage, larger, more showy flowers in looser, drooping racemes, and more succulent and palatable fruit.

*X *A. grandiflora* Rehder = *A. laevis* X *A. canadensis* (L.) Med.



Sweet Crab Apple, Fragrant Crab, American Crab Apple

Malus coronaria (L.) Mill. [*Pyrus coronaria* L.; *Malus fragrans* Rehd.]

- | | |
|--|---|
| 1. A twig showing flowers and immature leaves $\times \frac{1}{2}$ | 4. Fruit, lateral sectional view $\times 1$ |
| 2. A flower, lateral sectional view $\times 2$ | 5. Seed, lateral view $\times 2$ |
| 3. A branch showing mature leaves and fruit $\times \frac{1}{2}$ | 6. Winter twig $\times \frac{1}{2}$ |

ROSACEAE

Malus coronaria (L.) Mill. [*Pyrus coronaria* L.; *Malus fragrans* Rehd.]

Sweet Crab Apple, Fragrant Crab, American Crab Apple

Habit—A bushy shrub or small tree 20—30 feet in height with a trunk 6—14 inches in diameter. Trunk short, dividing 8—10 feet above the ground into several stout, wide-spreading limbs to form a broad, round-topped, bushy crown.

Leaves—Alternate, ovate to ovate-oblong, 3—4 inches long, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches broad, sharply acute at the apex, rounded or acute at the base, the margin incised-serrate with gland-tipped teeth or 3-lobed, at maturity rather thin, smooth, dark green above, pale green and glabrous or slightly pilose below, borne on slender petioles $1\frac{1}{2}$ —2 inches long.

Flowers—Perfect, fragrant, $1\frac{1}{2}$ —2 inches in diameter, long-pedicellate, appearing during May and early June when the leaves are nearly grown in 5—6-flowered, terminal umbels. Calyx urn-shaped, white-tomentose, 5-lobed, the lobes long, acute, subulate-tipped, spreading, hairy on the upper side, persistent in the fruit. Petals rosy-white, obovate, rounded at the apex, clawed at the base, entire or crenulate-serrate, inserted with the stamens on the calyx-tube. Stamens usually 20, shorter than the petals, the filaments united into a tube at the base. Pistil consisting of an inferior, 5-celled ovary, 5 filiform styles which are hairy and somewhat united below, and a like number of capitate stigmas.

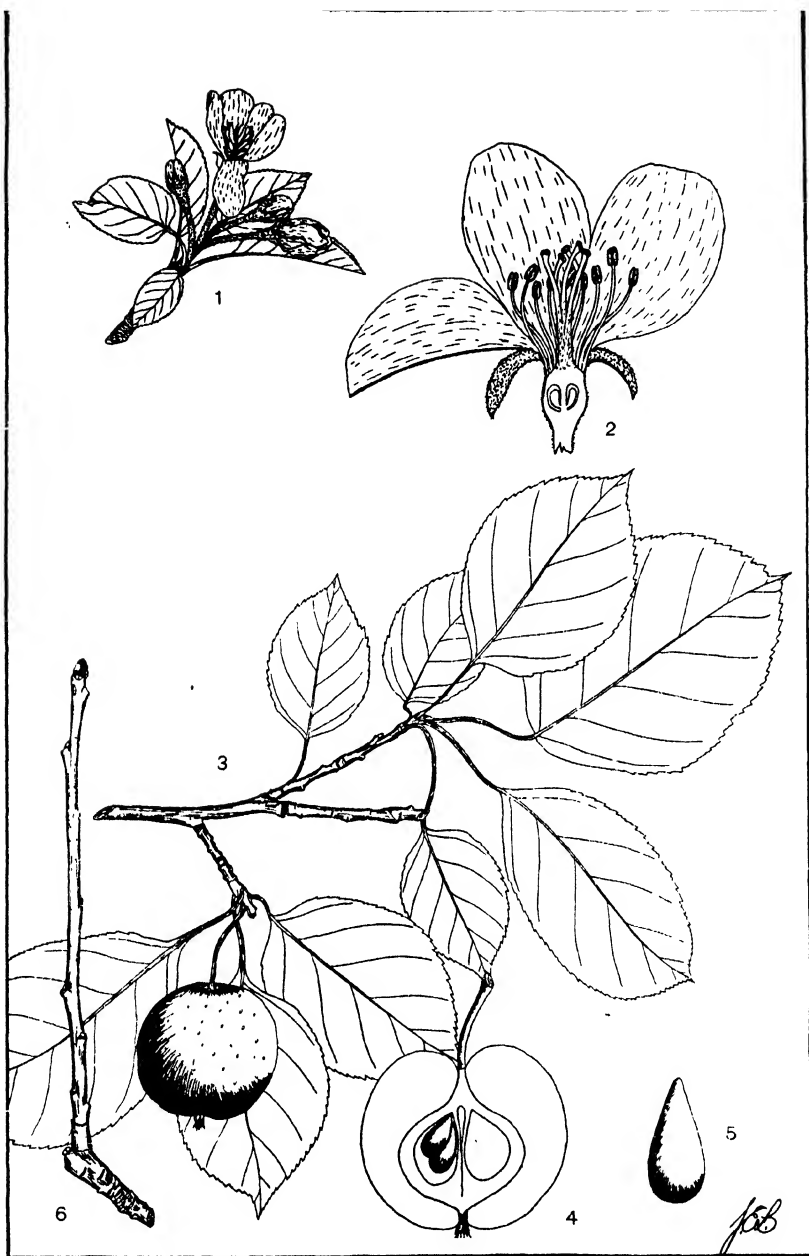
Fruit—A depressed-globose, green pome, 1— $1\frac{1}{4}$ inches in diameter, borne on a slender stalk $1\frac{1}{2}$ —2 inches in length, ripening in late autumn and becoming yellowish green and fragrant. Flesh very tart. Seeds chestnut-brown, lustrous.

Winter characters—Twigs rather stout, pale-lenticellate, glabrous or slightly pubescent, reddish brown. In the second year they become light brown and develop short, stout spurs or sharp spines. Buds ovate, obtuse or acute on the more vigorous shoots, bright red, $\frac{1}{8}$ — $\frac{1}{4}$ of an inch long. Mature bark thin, reddish brown, divided by shallow fissures into broad, flat-topped, scaly ridges.

Habitat—In rich moist soil, in copses, open woods, and along fences, occasionally forming thickets of limited extent.

Range—Western New York through southern Ontario and southern Michigan to southern Wisconsin, south to Pennsylvania, Delaware, and in the mountains to North Carolina, in the West south to Missouri.

Uses—Not a timber species. The acid fruit is sometimes made into preserves. The species is grown as an ornamental because of its showy, fragrant flowers, and several horticultural forms are recognized.



Wild Apple, Common Apple

Malus pumila Mill. [*Malus communis* DC.; *Malus malus* (L.) Britt.;
Pyrus malus L., in part]

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A branch with mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times \frac{3}{4}$
5. Seed, lateral view $\times 3$
6. Winter twig $\times \frac{1}{2}$

ROSACEAE

Malus pumila Mill. [*Malus communis* DC.; *Malus malus* (L.) Britt.;
Pyrus malus L., in part]

Wild Apple, Common Apple

Habit—A small tree, 30–50 feet in height, with a short trunk 1–3 feet in diameter which breaks up a few feet above the ground into stout, wide-spreading limbs to form a broad, rounded head.

Leaves—Alternate, broad-elliptic to elliptic and obovate, $1\frac{1}{2}$ –4 inches long, blunt or abruptly pointed at the apex, broad-cuneate or acutish at the base, irregularly crenate-serrate or entire, at maturity thick, dark dull green and quite glabrous above, pubescent beneath, borne on stout, pubescent petioles $\frac{3}{4}$ –2 inches long.

Flowers—Appearing during May and June when the leaves are about one-third grown, perfect, 1–2 inches in diameter, borne on stout, woolly pedicels in terminal, few-flowered cymes. Calyx gamosepalous, urn-shaped, woolly, 5-lobed, the lobes narrowly triangular and acute, reflexed, persistent in the fruit. Petals white or pinkish white, obovate, rounded at the apex, clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 20, shorter than the petals, the stout filaments bearing yellowish or purple anthers. Pistil consisting of an inferior, 5-celled ovary and 5 filiform, hairy styles, each terminated by a capitate stigma.

Fruit—A depressed-globose, waxy-green pome, 1–3 inches in diameter, marked at the top by the persistent calyx-lobes, borne on a slender stalk 1– $1\frac{1}{2}$ inches long, ripening and turning yellowish green or reddish in the autumn. Flesh coarse and sour. Seeds chestnut-brown, lustrous.

Winter characters—Twigs rather stout, sparingly pubescent or smooth, reddish or purplish brown, at length dark grayish brown and smooth. Fruit-spurs short, stout, roughened by numerous leaf-scars. Buds ovate, obtuse, tomentose, grayish white, $\frac{1}{8}$ – $\frac{1}{2}$ of an inch long. Mature bark thin, grayish brown, sloughing off in small, thin, irregular scales.

Habitat—A 'weed' tree growing as an 'escape' on a wide variety of sites in pastures, thickets, and along fences and roadsides. Seeds often disseminated by cattle which eat the sour fruit. Trees which are continually cropped in cow-pastures frequently assume odd forms.

Range—Supposed to have come originally from southeastern Europe and western Asia and cultivated since early times in the Old World. Introduced early by colonists into eastern North America and now widely naturalized in the eastern United States as an 'escape.'

Uses—Not a timber species. Wood hard, strong, close-grained, reddish brown with thin, pale sapwood. Used for firewood and occasionally for tool handles. The importance of the species lies in its horticultural value as the stock from which most of the varieties of cultivated apples have been derived. Dwarf- and double-flowered forms are grown ornamentally, and various hybrids are recognized.



Pear

Pyrus communis L.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A branch with mature leaves $\times \frac{1}{2}$
4. A branch with mature leaves and fruit $\times \frac{1}{2}$
5. Fruit, lateral sectional view $\times \frac{1}{2}$
6. Seed, lateral view $\times 2$
7. Winter twig $\times \frac{1}{2}$

ROSACEAE
***Pyrus communis* L.**

Pear

Habit—A slow-growing, long-lived tree attaining under optimum conditions a height of 65 feet with a trunk diameter of 2 feet, usually much smaller in cultivation. Bole straight, continuous into the crown, bearing short, stout, ascending branches which form an oblong or pyramidal crown.

Leaves—Alternate, orbicular-ovate to elliptic and obovate, 1—4 inches long, $\frac{3}{4}$ —1½ inches wide, acute or short-acuminate at the apex, obtuse or rounded at the base, finely crenate-serrulate or entire, at maturity thick, smooth, dark green and lustrous above, paler and smooth below, borne on slender petioles $\frac{1}{2}$ —4 inches long.

Flowers—Appearing in April and May with the leaves, perfect, $\frac{3}{4}$ —1 inch in diameter, borne on slender, usually downy pedicels in few- or many-flowered, umbel-like cymes on short spur-like branches of the previous season. Calyx gamosepalous, urn-shaped, pubescent, 5-lobed, the lobes acuminate, as long as the tube, and ciliate on the margin. Petals white, broadly obovate, rounded at the apex, contracted at the base, inserted with the stamens on the calyx-tube. Stamens about 20, shorter than the petals. Pistil consisting of an inferior, 5-celled ovary and 5 styles which are connate at the base and bear capitate stigmas.

Fruit—A pyriform or subglobose, waxy-green pome, about 2 inches long in the wild form, marked at the top by the persistent calyx-lobes and stamen-filaments, borne on a slender stalk about 1 inch long, ripening and turning yellowish green in the autumn. Flesh in the wild form rather dry, sour, permeated with grit cells. Carpels coriaceous, enclosing 2 lustrous brown seeds.

Winter characters—Twigs stout, nearly smooth and somewhat lustrous, brownish red with scattered, pale-yellow lenticels. Short spinescent twigs commonly present. In addition fruiting-trees have stout, slow-growing fruit-spurs marked by numerous leaf-scars. Terminal buds conical, sharply acute, smooth or slightly pubescent at the tip, chestnut-brown, about $\frac{1}{2}$ of an inch long. Mature bark thin, grayish brown, at first smooth, at length dissected by shallow fissures into broad, flat, scaly ridges.

Habitat—Thickets, open woods fence rows, old pastures and waste lands, occurring as an 'escape.' Seeds often disseminated by cattle which eat the acidulous fruit.

Range—Native to Eurasia but now widely cultivated in its various varieties for its fruit throughout the temperate regions of the World. Occasionally occurring as an 'escape' in the Northeastern States.

Uses—Not a timber species in this country. Wood hard, heavy, strong, close-grained, reddish brown with paler sapwood. Used occasionally for tool handles, knife handles, turnery, wood engraving, and for fuel. The value of the species lies in its horticultural and ornamental varieties.



Coffee Tree, Kentucky Coffee-tree

Gymnocladus dioica (L.) K. Koch [*Gymnocladus canadensis* Lam.]

1. An inflorescence from the staminate tree x $\frac{1}{2}$
2. A staminate flower, lateral sectional view x 2
3. A pistillate flower, lateral sectional view x 2
4. A mature leaf x $\frac{1}{2}$
5. Fruit, lateral view x $\frac{1}{2}$
6. Seed, lateral view x 1
7. Winter twig x $\frac{1}{2}$

LEGUMINOSAE

Gymnocladus dioica (L.) K. Koch [*Gymnocladus canadensis* Lam.]

Coffee Tree, Kentucky Coffee-tree

Habit—A large tree, under favorable conditions sometimes attaining a height of 110 feet with a trunk diameter of 2–3 feet, generally much smaller in central and western New York. Trunk usually short, dividing ten or fifteen feet above the ground into several stout, ascending limbs to form a narrow, obovate crown. Under forest conditions the bole may be columnar and free of branches for 70–80 feet. A very intolerant species.

Leaves—Alternate, bipinnate, 1–3 feet long, $1\frac{1}{2}$ –2 feet broad, with 3–9 (usually 3–7) pairs of pinnae (the lowest usually reduced to 1–2 basal pairs of lobed leaflets), borne on glabrous, terete, purplish green leaf-stalks which are prominently enlarged at the base. Pinnae consisting of 6–14 leaflets borne suboppositely or alternately on the secondary rachis. Leaflets ovate to elliptic-ovate, acute and often mucronate at the apex, rounded or acute and inequilateral at the base, entire, at maturity thin, dark green and glabrous above, paler beneath, short-stalked, 2– $2\frac{1}{2}$ inches long, turning yellow and falling separately in the autumn.

Flowers—Appearing in June after the leaves, regular, greenish white, polygamous, borne in terminal racemes or panicles. Staminate inflorescence 3–4 inches long, the lower branches usually several-flowered. Pistillate inflorescence 10–12 inches long, the flowers fewer and longer-stalked than in the staminate clusters. Calyx about $\frac{3}{4}$ of an inch long, narrowly tubular, white-tomentose, 10-ribbed and 5-lobed, the lobes linear-lanceolate. Petals oblong, slightly keeled and inrolled, nearly white, tomentose on the inner surface, longer than the calyx-lobes. Stamens 10, included, inserted on the calyx-tube, with awl-shaped hairy filaments and orange anthers. Pistil consisting of a hairy, linear-lanceolate, sessile ovary, short style, and oblique stigma.

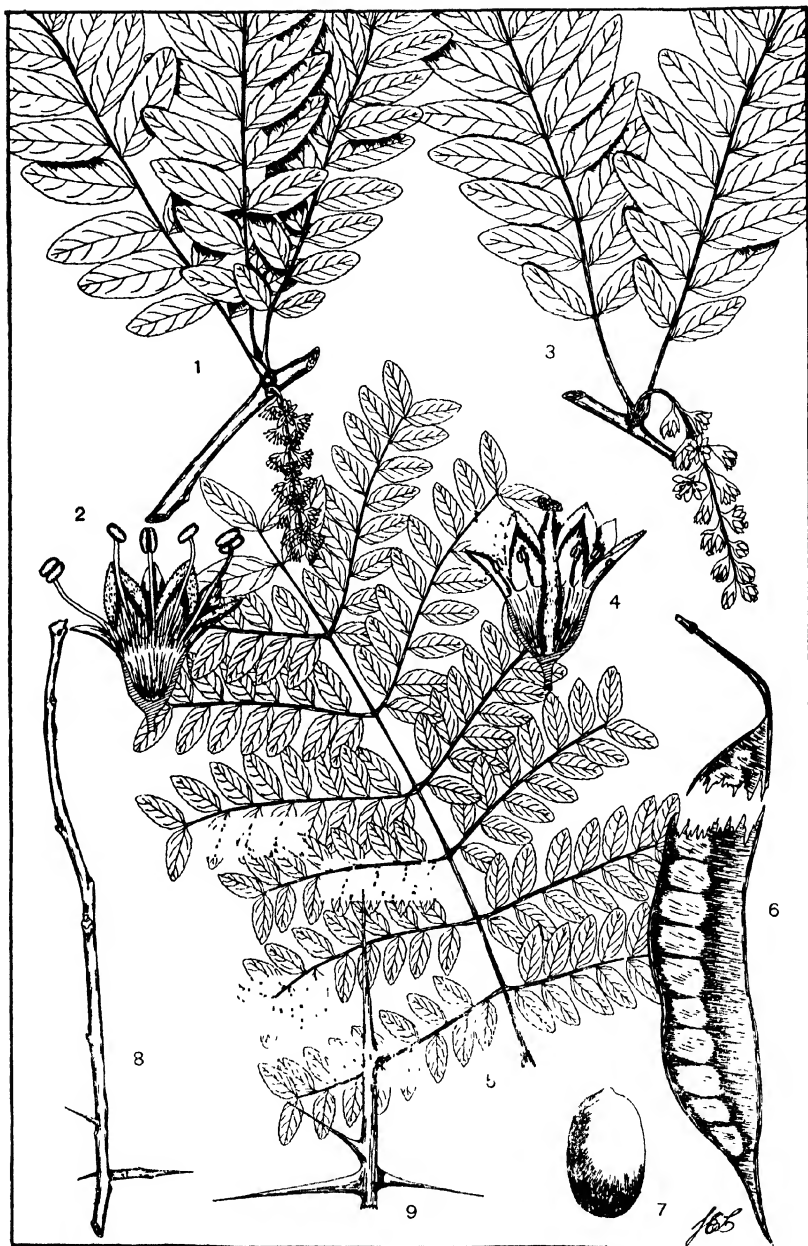
Fruit—A broad, flat, thick, somewhat glaucous, dark reddish brown, woody legume, 4–10 inches long, 1–2 inches broad, borne on a stout stalk 1–2 inches long, persisting on the trees into the winter. Flesh between the seeds thick, dark-colored, sweet. Seeds ovoid to slightly obovoid dark brown, somewhat compressed, very thick-walled, about $\frac{3}{4}$ of an inch long.

Winter characters—Twigs very stout, blunt-pointed, dark brown or greenish brown and usually with a pale evanescent skin, marked with orange-colored lenticels and broad, heart-shaped leaf-scars. Pith large, salmon-colored. Terminal bud absent. Lateral buds 2 or 3 at a node, small, bronze, silky-pubescent, sunken in the twig so that they scarcely project beyond its surface, surrounded by a hairy, incurved ring of bark. Accessory buds superposed, the upper the larger. Mature bark rather thick, dark grayish brown, divided by shallow fissures into shallow ridges covered with reflexed scales.

Habitat—In the wild state a typical bottomland species, preferring deep, rich, alluvial soils in company with Black Ash, Cottonwood, Honey Locust, etc. Will thrive in drier situations if not overtopped by other species.

Range—Western New York and western Pennsylvania through southern Ontario and southern Michigan to Minnesota and southeastern South Dakota, south to Tennessee, southwestern Arkansas and northeastern Oklahoma.

Uses—Of wide distribution but one of the rarest forest trees of eastern United States. Wood medium hard, medium heavy, coarse-grained, light red to reddish brown with thin, paler sapwood. Occasionally used for fence posts, railroad ties, in cabinet making and in general construction. Widely planted as an ornamental tree in parks, cemeteries, and gardens because of its striking appearance, particularly during the winter months. The large dark brown seeds resemble coffee-kernels superficially, hence the name, 'Kentucky Coffee-tree.'



Honey Locust
***Gleditsia triacanthos* L.**

- | | |
|---|--|
| 1. A twig showing staminate flowers and mature pinnate leaves x $\frac{1}{2}$ | 5. A bipinnate leaf x $\frac{1}{2}$ |
| 2. A staminate flower, lateral sectional view x 3 | 6. Fruit, lateral view x $\frac{1}{2}$ |
| 3. A twig showing pistillate flower and mature pinnate leaves x $\frac{1}{2}$ | 7. Seed, lateral view x 2 |
| 4. A pistillate flower, lateral sectional view x 3 | 8. Winter twig x $\frac{1}{2}$ |
| | 9. Branched thorn x $\frac{1}{2}$ |

LEGUMINOSAE
***Gleditsia triacanthos* L.**

Honey Locust

Habit—Usually a medium-sized tree 40—80 feet high with a trunk diameter of 1—3 feet, under favorable conditions on rich river bottoms occasionally 140 feet tall and 5—6 feet through at the butt. Trunk generally short, characteristically marked with clumps of thorns, dividing a few feet above the ground into a number of stout, ascending limbs and slender, spreading, somewhat pendulous, zigzag branches to form a broad-obovate or flat-topped head. Propagates readily by seeds but requires full light. A fast-growing species.

Leaves—Alternate, pinnate or bipinnate, 6—8 inches long, borne on flattened, pubescent petioles which are grooved above and enlarged at the base. Pinnate leaves with 20—30 nearly sessile leaflets borne suboppositely or alternately on a hairy rachis. Leaflets oblong-lanceolate to elliptic, bluntly acute or rounded at the apex, acute and slightly inequilateral at the base, remotely crenulate-serrate, increasing in size from the base to the apex of the leaf, at maturity dark green and lustrous above, dull yellowish green and pubescent on the midrib below, $\frac{1}{4}$ — $1\frac{1}{4}$ inches long. Bipinnate leaves with 4—7 pairs of pinnae, the upper sometimes reduced to single leaflets. Pinnules similar to those of the pinnate leaves but smaller.

Flowers—Appearing in June when the pinnate leaves are nearly full grown, small, greenish, polygamous, borne in lax racemes from the axils of the leaves of the season or of preceding seasons. Staminate racemes often clustered, pubescent, densely-flowered, 2— $2\frac{1}{2}$ inches long at maturity. Pistillate racemes slender, few-flowered, usually solitary, $2\frac{1}{2}$ — $3\frac{1}{2}$ inches long. Calyx campanulate, unequally 5-lobed, the lobes acute and hairy. Petals oval or oblong-oval, erect, longer than the calyx-lobes, the margin inrolled and pubescent. Stamens 10, exserted, inserted on the calyx-tube, with slender filaments and green anthers. Pistil consisting of a linear-lanceolate, white-tomentose, subsessile, 1-celled ovary, a short style, and a terminal capitate stigma.

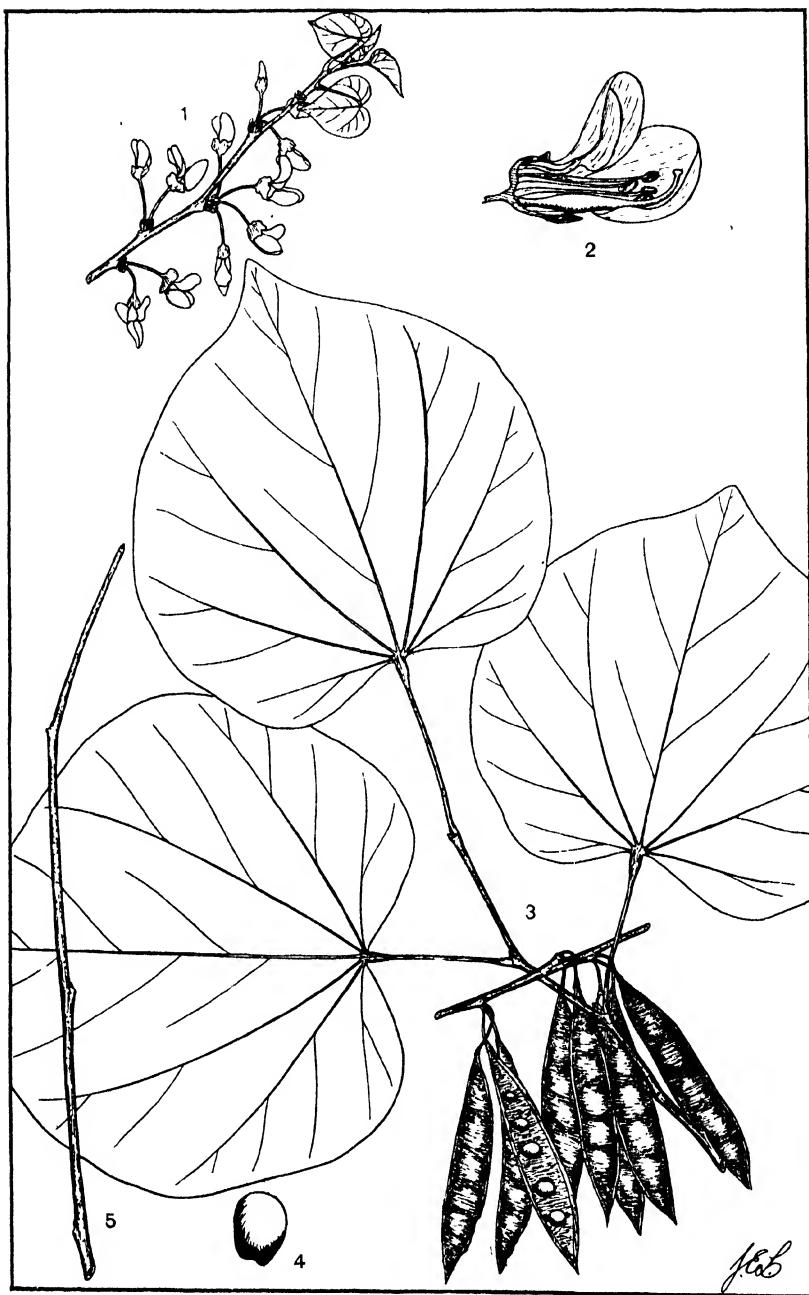
Fruit—A flat, thin, thick-margined, somewhat falcate and twisted, reddish or purplish brown legume, 12—18 inches long, 1— $1\frac{1}{4}$ inches wide, tapering at either end, borne in clusters of 2 or 3 on short stalks, tardily deciduous during the fall and winter. Flesh thick, succulent. Seeds oval, compressed, brown, about $\frac{1}{3}$ of an inch long. The fruits are often blown considerable distances over the snow in the winter, thus increasing seed distribution.

Winter characters—Twigs rather stout, zigzag, thickened at the nodes and apex, lustrous, reddish or greenish brown, at length grayish brown. Simple or branched thorns, often 3—4 inches long, are borne above the leaf-scars and on the trunk and main branches of some trees. Terminal bud absent. Lateral buds minute, several at a node, superposed, the upper larger and scaly, the lower wholly submerged in the bark. Mature bark rather thick, grayish brown to almost black, usually roughened and divided by deep fissures into long, narrow, longitudinal ridges which are scaly on the surface.

Habitat—By preference a bottomland species, attaining its best development in deep, moist soils along stream courses, but occupying a variety of sites in rich woods and on moist mountain slopes.

Range—Pennsylvania (western Alleghenies) through southern Ontario and central Michigan to southeastern Minnesota, south in the mountains to Georgia and northern Alabama (a small area in northwestern Florida), in the West extending to eastern Oklahoma and eastern Texas.

Uses—A timber species of secondary value southward. Wood hard, heavy, strong, coarse-grained, very durable in contact with the soil, light red to reddish brown with thin pale sapwood. Used for railroad ties, fence posts and occasionally in construction. This species has been widely propagated as a hedge plant because of its vigorous growth and well-armed branches. It is especially free from fungal and insect enemies and is to be recommended as an ornamental tree. Several varieties are recognized.



Red Bud, Judas Tree

Cercis canadensis L.

1. A twig showing flowers and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 2$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Seed, lateral view $\times 3$
5. Winter twig $\times \frac{1}{2}$

LEGUMINOSAE
***Cercis canadensis* L.**

Red Bud, Judas Tree

Habit—A large shrub or small tree 20—25 feet in height with a trunk diameter of 5—8 inches, occasionally 50 feet tall with a trunk a foot through at the butt. Trunk straight, usually separating 8—10 feet above the ground into a number of stout limbs which are either ascending and form an ovate crown, or wide-spreading, forming a flat, shallow, broad crown.

Leaves—Alternate, broadly ovate, 3—5 inches in diameter, abruptly acute or acuminate at the apex, cordate or truncate at the base, entire, 5—7-nerved, at maturity medium thick, glabrous, bright green above, paler and glabrous below aside from the tufts of hairs in the axils of the veins, borne on slender petioles which are thickened at either end and 2—5 inches long.

Flowers—Appearing in March and April before the leaves or as the leaf-buds open, perfect, falsely papilionaceous, about $\frac{1}{2}$ of an inch long, borne on slender pedicels $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long in lateral fascicles of 4—8. Calyx-tube dark purplish red, campanulate, oblique and gibbous at the base, the 5 lobes short and rounded. Petals pink or rose-colored, oblong-ovate, rounded at the apex, the upper one the smallest and enclosed by the lateral wing-petals and the basal keel-petals. Stamens 10, separate, shorter than the petals, inserted in 2 rows on the margin of the disk. Pistil short-stalked, inserted obliquely in the bottom of the calyx-tube, consisting of a pubescent, 1-celled, many-ovuled ovary, a filiform, upcurved style, and a capitate stigma.

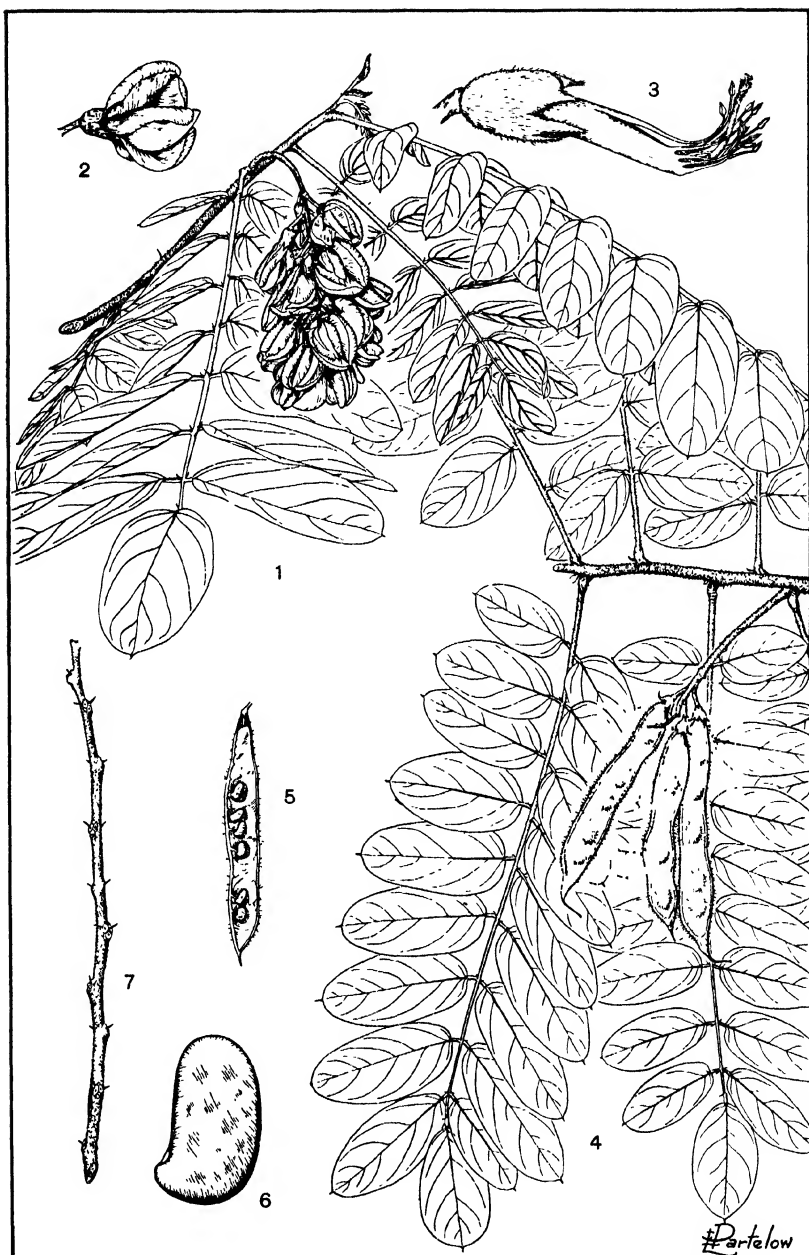
Fruit—A short-stalked, oblong or linear-oblong, compressed legume, $2\frac{1}{2}$ — $3\frac{1}{2}$ inches long, curved on one side, acute at either end, attaining full size and turning pink or light brown by midsummer but persisting on the trees into the autumn and early winter. Seeds broadly ovoid or oblong, compressed, thick-walled, chestnut-brown, about $\frac{1}{4}$ of an inch long.

Winter characters—Twigs slender, zigzag, glabrous and somewhat lustrous, dotted with many small lenticels, light brown, at length grayish brown. Terminal bud absent. Lateral buds blunt, appressed, dark purplish red, about $\frac{1}{8}$ of an inch long. One or two accessory, superposed buds often present, the upper one the largest. Mature bark thin, reddish brown to dark brown, shallowly reticulately fissured and scaly.

Habitat—In rich moist soils on bottomlands, along the borders of streams, on brush lands, and in open forest where, in its native range, it often forms a large part of the understory growth.

Range—Southeastern New York and New Jersey westward through Pennsylvania and southern Ontario to southern Michigan, south to Florida and eastern Texas.

Uses—Of no importance as a timber species because of its small size. Cultivated in this country and abroad for its ornamental value. Several varieties are recognized including var. *alba* Rehd., with white flowers.



Clammy Locust

Robinia viscosa Vent. [*Robinia glutinosa* Sims]

1. A flowering branch $\times \frac{1}{2}$
2. A flower, lateral view $\times 1$
3. A flower with corolla removed, lateral view $\times 2$
4. A branch showing mature leaves and fruit $\times \frac{1}{2}$
5. Fruit with one valve removed, showing seeds $\times \frac{1}{2}$
6. Seed, lateral view $\times 5$
7. Winter twig $\times \frac{1}{2}$

LEGUMINOSAE

Robinia viscosa Vent. [*Robinia glutinosa* Sims]

Clammy Locust

Habit—A low shrub 5–6 feet in height, more frequently a small tree 30–40 feet in height with a short trunk 10–12 inches in diameter supporting a rounded crown of slender, spreading branches.

Leaves—Alternate, odd-pinnately compound, 4–12 inches long, with slender stipules which are either deciduous or develop into slender, weak, divergent spines, consisting of 11–21 subopposite or alternate leaflets arranged along a dark, stout, shallowly-grooved, glandular-viscid rachis which is swollen at the base. Leaflets ovate-oblong to elliptical, 1–1½ inches long, obtuse and usually mucronate at the apex, rounded at the base, entire, with caducous stipels, at maturity dark green and nearly glabrous above, paler and pubescent or sometimes glabrous below, thicker than those of the following species, borne on stout petioles about ¼th of an inch long, turning yellow and falling early in the autumn.

Flowers—Appearing in June when the leaves are nearly grown, perfect, irregular, pale-rose, nearly inodorous, about ½th of an inch long, borne on slender, reddish pedicels in short, ovate, 6–16-flowered, crowded, glandular-hispid racemes 2–¾ inches long. Calyx campanulate, slightly gibbous on the upper side, greenish red, pilose on the outer surface and on the margins of the 5 subulate lobes, the lower lobe longer than the others. Corolla papilionaceous, consisting of a narrow, obcordate, reflexed 'standard' (one petal) marked on the inner surface with a yellow blotch, two broad oblong-falcate 'wings' (one petal each), and a curved 'keel' (two petals united below). Stamens 10, diadelphous, the upper one free, the others united into a cylinder which is cleft on the upper side and encloses the ovary. Pistil consisting of a linear-oblong, stipitate ovary, a geniculate subulate style bearded toward the top on the inner side, and a small terminal stigma.

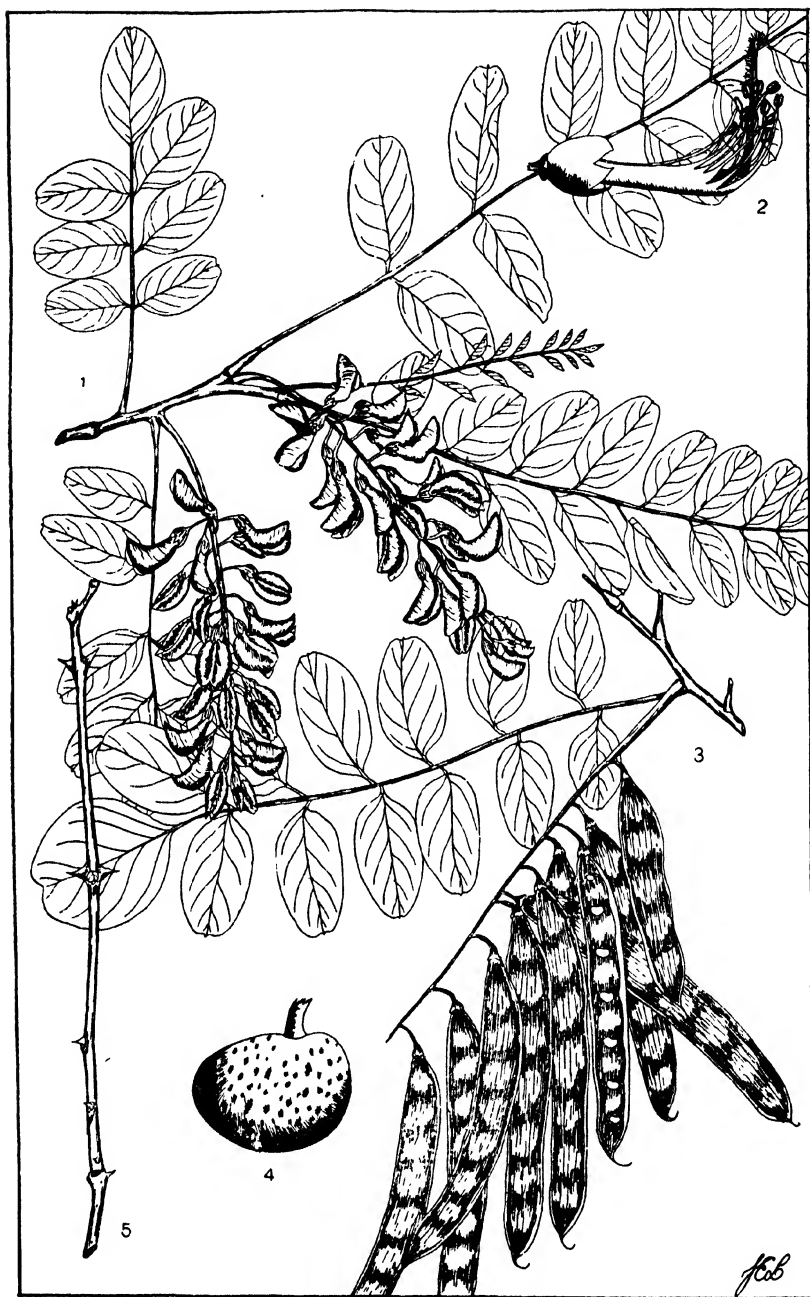
Fruit—A flat, narrow-oblong, narrowly winged, sparingly glandular-hispid, reddish brown legume, 2–3½ inches long, approximately ½ of an inch wide, tipped by the remnants of the slender style, borne on a stout, glandular-hispid stalk. Seeds reniform, compressed, dark reddish brown and mottled, about ⅓th of an inch long, borne on a curved funiculous, about 4–8 to a pod.

Winter characters—Twigs slender, brittle, more or less zigzag, terete or angular in cross section, very sticky (clammy), bright red-brown with small black lenticels, turning light brown and becoming dry the second season. Slender, weak, divergent spines present on vigorous growth. Terminal bud absent. Lateral buds small, 3–4 at a node (2–3 superposed), imbedded in the twig under the leaf scar, at length erumpent. Mature bark thin, dark brown tinged with red, smooth.

Habitat—Within its natural range, this species prefers rocky sites on moist, fertile mountain slopes. Not exacting in its soil requirements in cultivation, but strongly acid soils should be avoided.

Range—Restricted to the mountains of North Carolina and South Carolina and one of the rarest trees of the United States. Widely cultivated as an ornamental in eastern United States as far north as New England, and occasionally becoming naturalized.

Uses—An excellent ornamental because of its good form, handsome foliage, and showy, rose-colored flowers. Too rare to be of any value as a source of wood or other products within its natural range.



Black Locust, Yellow Locust, White Locust, False Acacia

Robinia pseudoacacia L.

- | | |
|---|--|
| 1. A flowering branch $\times \frac{1}{2}$ | 3. A branch showing mature leaf and fruit $\times \frac{1}{2}$ |
| 2. A flower with corolla removed, lateral view $\times 2$ | 4. Seed, lateral view $\times 5$ |
| | 5. Winter twig $\times \frac{1}{2}$ |

LEGUMINOSAE

Robinia pseudoacacia L.

Black Locust,* Yellow Locust, White Locust, False Acacia

Habit—An intolerant, medium-sized tree usually 40–60 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes 100 feet tall and 3 feet through at the butt. In the open the bole is short and divides a few feet above the ground into a number of stout, ascending branches which form a narrow, oblong, open crown. The trunk of forest-grown specimens is often free of branches for three-fourths of its length. Produces stump-sprouts and root-suckers, often forming extensive thickets. Can be propagated by 'cuttings'.

Leaves—Alternate, odd-pinnately compound, 8–14 inches long, consisting of 7–19 subopposite or alternate leaflets arranged along a slender, puberulous rachis which is grooved above and swollen at the base. Stipules subulate, membranous, often developing later into stipular thorns. Leaflets elliptic, oval, or ovate, $1\frac{1}{2}$ –2 inches long, obtuse and mucronate or retuse at the apex, rounded at the base, entire, with caducous stipels, at maturity dull, dark blue-green and glabrous above, paler and glabrous below except on the midrib, borne on stout petiolules $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, turning yellow and falling early in the autumn.

Flowers—Appearing in late May or early June when the leaves are nearly grown, perfect, irregular, white, fragrant, about 1 inch long, borne on slender reddish pedicels in drooping, puberulous racemes 4–5 inches long. Calyx campanulate, gibbous on the upper side, reddish green and pilose, persistent, 5-lobed, the lower lobe longer than the others. Corolla papilionaceous, consisting of a broad, obcordate, reflexed 'standard' (one petal) marked on the inner surface with a yellow spot, two oblong falcate 'wings' (one petal each), and a curved 'keel' (two petals united below). Stamens 10, diadelphous, the upper free or nearly so, the remainder united into a cylinder which is cleft on the upper side and encloses the ovary. Pistil consisting of a linear-oblong, stipitate ovary, a geniculate, subulate style bearded toward the top on the inner side, and a small terminal stigma.

Fruit—A flat, oblong-linear, somewhat falcate, glabrous, reddish brown legume, 2–4 inches long, $\frac{1}{2}$ of an inch wide, borne in drooping, many-fruited racemes, early dehiscent but persisting on the trees into the winter. Seeds oblong-oblique to reniform, compressed, orange-brown with irregular darker markings, about $\frac{1}{8}$ of an inch long, borne on a curved funiculus, 4–8 to a pod. The seeds are slow to germinate but have high fertility.

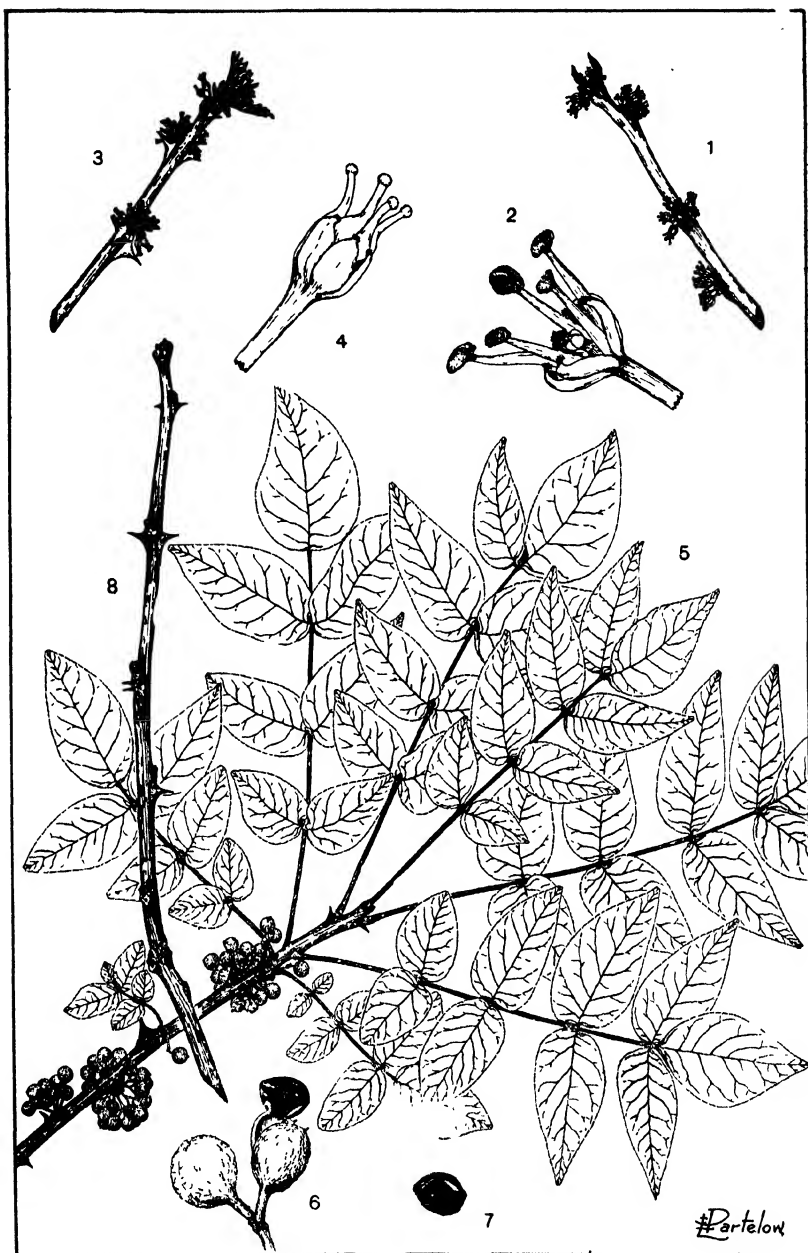
Winter characters—Twigs slender or rather stout on vigorous growth, brittle, more or less zigzag, terete or angular in cross section, glabrous, light reddish to greenish brown. Divergent or slightly recurved stipular-thorns present on vigorous growth. Terminal bud absent. Lateral buds small, 3–4 at a node (2–3 superposed), imbedded in the twig under the leaf-scar, at length erumpent. Mature bark thick, reddish or yellowish brown, deeply furrowed into rounded ridges covered with squarish persistent scales.

Habitat—Moist, fertile mountain slopes and along stream courses in rocky, gravelly or alluvial soils. Thrives on limestone outcrops.

Range—Slopes of the Appalachian Mountains from Pennsylvania to northern Georgia, westward through southwestern Indiana and southern Illinois to Iowa, Missouri and eastern Oklahoma. Now widely naturalized in the United States east of the Rocky Mountains.

Uses—A valuable timber species, but in certain sections subject unfortunately to the attacks of several serious pests including the Locust Borer. Wood very hard, heavy, strong, very durable, greenish yellow to dark yellowish, greenish, or golden-brown, with narrow, pale yellow sapwood. Used for fence posts, insulator pins, treenails, railroad ties, in shipbuilding, etc. Widely planted both at home and abroad for timber and ornament.

*Numerous varieties are recognized in cultivation and several wild forms occur, based on variations in the habit of the tree (Ex.—var. *inermis* DC., with unarmed twigs), appearance of the bark, color and durability of the wood, etc. For further information, see Raber, Shipmast Locust, A Valuable Undescribed Variety of *Robinia Pseudoacacia*, U.S.D.A., Circ. 379, 1936.



Northern Prickly Ash, Tooth-ache Tree

Zanthoxylum americanum Mill.

1. A twig showing staminate flowers $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times \frac{1}{5}$
3. A twig showing pistillate flowers $\times \frac{1}{2}$
4. A pistillate flower, lateral view $\times 5$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. A twig-tip showing two capsular fruits, one with an exserted seed $\times 2$
7. Seed, lateral view $\times 2$
8. Winter twig $\times \frac{1}{2}$

RUTACEAE
***Zanthoxylum americanum* Mill.**

Northern Prickly Ash, Tooth-ache Tree

Habit—Usually a prickly, aromatic shrub 5—10 feet in height, sprouting abundantly from the roots and hence sometimes forming extensive thickets, rarely a small, round-topped tree approximately 20 feet in height with numerous branches spreading nearly at right angles and a short trunk up to 8 inches in diameter.

Leaves—Deciduous, alternate, odd-pinnately compound, 4—12 inches long, borne on a nearly terete rachis, consisting of 5—11 leaflets, the lateral leaflets paired; leaflets ovate-oblong or rarely oval, $1\frac{1}{2}$ — $2\frac{3}{4}$ inches long, obtuse or acuminate at the apex, rounded or slightly cordate and sometimes somewhat inequilateral at the base, crenate with flat-topped teeth, with pellucid dots, deep green above, paler and somewhat pubescent below, sessile or short petiolate.

Flowers—Appearing in April and May before the leaves (from separate flower-buds), in axillary, clustered, sessile cymes on wood of the previous season, greenish yellow, dioecious, slender-pedicelled. Calyx none. Petals 4—5, pubescent at the apex, approximately $\frac{1}{8}$ th of an inch in length. Staminate flowers consisting of 4—5 exserted stamens which alternate with the linear, thickened petals, with rudimentary pistils. Pistillate flowers with oblong-ovate petals and 3—5 pistils which are about twice the length of the petals and consist of a 1-celled ovary, a rather stout style, and a terminal stigma.

Fruit—Composed of 1-several capsular pods, each derived from a single carpel (simple pistil); pod globose or elliptical, thick and fleshy, wrinkled, glandular-punctate, 2-valved, 1-seeded, about $\frac{1}{4}$ th of an inch in diameter, lemon-scented when crushed. Seed ovoid, black, lustrous, finally exserted from the capsule, about $\frac{3}{4}$ ths of an inch long; seed-coat thick.

Winter characters—Twigs with conspicuous stipular spines, rather stout, brittle, more or less zigzag, terete or angular in cross section, smooth, dull brownish red turning brownish gray the second season. Stipular spines stout, divergent, sharp, about $\frac{1}{4}$ th of an inch long, persisting for a number of years. Buds red-tomentose; terminal bud flattened-conical, about $\frac{1}{8}$ th of an inch long; lateral buds semi-oval, blunt, appressed. Mature bark blackish gray, smooth except for the stipular spines some of which persist for a number of years.

Habitat—Rocky woods and river banks where it often forms extensive thickets. Thrives on thin limestone soils if sufficient moisture is available.

Range—Western Quebec and Ontario to Minnesota, south to Virginia, Kentucky, Missouri and eastern Kansas.

Uses—The name—*Zanthoxylum*—comes from the Greek and means 'yellow wood,' but this species is too small to be productive of timber. Not used extensively as an ornamental because of its spiny twigs. The bark, especially that of the roots, contains a bitter principle which is a powerful stimulant and tonic; it is sometimes used in the treatment of rheumatism and to alleviate tooth-ache, hence the common name—Tooth-ache Tree. Most of the prickly ash berries of the drug trade are obtained from this species.



Hop-tree, Wafer Ash

Ptelea trifoliata L.

1. A twig showing inflorescence and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral sectional view $\times 3$
3. A pistillate flower, lateral sectional view $\times 3$
4. A branch showing mature leaves and fruit $\times \frac{1}{2}$
5. Fruit, lateral sectional view $\times 1$
6. Seed, sectional view $\times 3$
7. Winter twig $\times \frac{1}{2}$

RUTACEAE
***Ptelea trifoliata* L.**

Hop-tree, Wafer Ash

Habit—A shrub or small tree 20—25 feet in height with a trunk diameter of 6—8 inches. Trunk straight, slender, bearing a round-headed crown of many slender twigs. Tolerant of shade.

Leaves—Alternate or rarely opposite, trifoliate or 4—5-foliate on vigorous shoots, long-petioled, strong-scented when crushed. Leaflets sessile, ovate to elliptic-oblong, acute or acuminate at the apex, cuneate to broad-cuneate or rounded at the base, entire or obscurely crenulate, punctate with pellucid dots, at maturity dark green and lustrous above, paler and usually glabrous beneath, 4—6 inches long, 2½—3 inches wide. Terminal leaflet larger than the lateral leaflets, more contracted at the base. Lateral leaflets inequilateral at the base. Petioles stout, thickened at the base, 2½—3 inches long. The foliage turns clear yellow in the autumn.

Flowers—Appearing in June after the leaves, ill-scented, greenish white, polygamous, borne intermixed on slender pedicels in terminal, often compound cymes. Calyx 4—5-parted, with ovate, acute lobes. Petals 4—5, hypogynous, longer than the sepals. Stamens 4—5, alternate, exerted in the staminate flowers, much smaller or abortive in the pistillate flower. Pistil consisting of an oblong, compressed, puberulent ovary surmounted by a short style and a 2—3-lobed stigma.

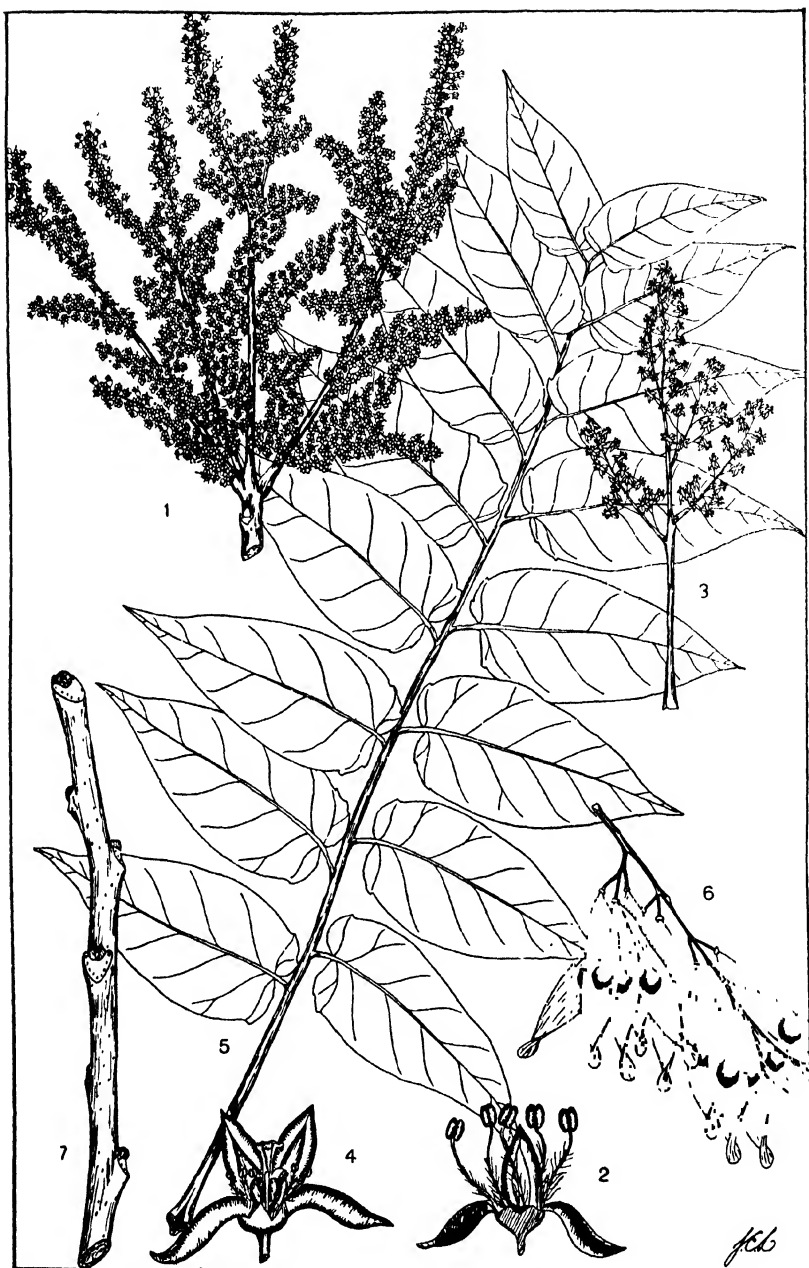
Fruit—A nearly orbicular or slightly obovate, winged, buff-colored, 2-celled, 2-seeded samara. Wing broad, reticulate. The fruits ripen in the late autumn and are borne on long, slender, reflexed pedicels which persist on the twigs during the winter.

Winter characters—Twigs slender, yellowish brown, lustrous, conspicuously marked by leaf-scars, with a rank odor when broken. Terminal bud absent. Lateral buds small, whitish-hairy, rotund, borne in the upper angle of V-shaped leaf-scars. Superposed buds present. Mature bark thin, smooth, dark gray, with numerous, oblong, wart-like excrescences.

Habitat—On rocky, upland slopes about the borders of forests and woods, often in the shade of other trees.

Range—Southern Ontario, Chemung and Tompkins counties, N. Y., and Long Island, N. Y., westward through Pennsylvania, southern Michigan and southern Iowa to Nebraska, south to Georgia and Texas.

Uses—Occasionally propagated as an ornamental plant in the parks and gardens of eastern United States. The bitter bark of the roots is sometimes used in the form of tinctures and fluid extracts as a tonic. The bitter fruit is occasionally substituted for hops in brewing beer.



Ailanthus, Tree of Heaven, Chinese Sumach

***Ailanthus altissima* (Mill.) Swingle** [*Ailanthus glandulosa* Desf.;

***Ailanthus cacodendron* (Ehrh.) Schinz et Thell.]**

1. A staminate inflorescence $\times \frac{1}{2}$
2. A staminate flower, lateral section-
al view $\times 10$
3. Portion of a pistillate inflorescence
 $\times \frac{1}{2}$
4. A pistillate flower with one petal
removed, lateral view $\times 10$
5. A mature leaf $\times \frac{1}{2}$
6. A cluster of samaras $\times \frac{1}{2}$
7. Winter twig $\times \frac{1}{2}$

SIMAROUBACEAE

Ailanthus altissima (Mill.) Swingle [*Ailanthus glandulosa* Desf.;
Ailanthus cacodendron (Ehrh.) Schinz et Thell.]

Ailanthus, Tree of Heaven, Chinese Sumach

Habit—In the Northeast usually a medium-sized tree 30–65 feet in height with a trunk diameter of $\frac{3}{4}$ –2 feet, occasionally where conditions are favorable 100 feet tall with a trunk 40 inches in diameter at the butt. Bole usually short, dividing 6–10 feet above the ground into a few, stout, ascending limbs to form a wide, flat-topped crown of sparse, coarse branches.

Leaves—Alternate, odd-pinnately compound, 1–3 feet long, consisting of 13–41 short-stalked, subopposite or alternate leaflets arranged along a long, tapering, smooth rachis. Leaflets ovate-lanceolate, 3–5 inches long, acuminate at the apex, truncate or cordate and somewhat inequilateral at the base, finely ciliate, entire except for a few coarse teeth toward the base, at maturity thin, light green and glabrous above, glabrous and glaucous beneath, often glandular beneath on the basal lobes. Foliage ill-scented when crushed.

Flowers—Appearing during June after the leaves are fully developed, polygamous, greenish white, about $\frac{1}{4}$ of an inch broad, borne in terminal panicles, the staminate panicles often a foot in length, densely-flowered and ill-scented, the pistillate smaller and fewer flowered. Calyx 5-lobed, the lobes broadly ovate, acute. Petals 5, oval, acute, valvate, inrolled, much longer than the sepals. Stamens 10 in the staminate flowers, inserted with the petals on the edge of the disk, exserted, the filaments hairy toward the base. Perfect flowers with 2–3 stamens. Pistil consisting of a deeply 2–5-lobed ovary surmounted by an equal number of short styles and spreading stigmas.

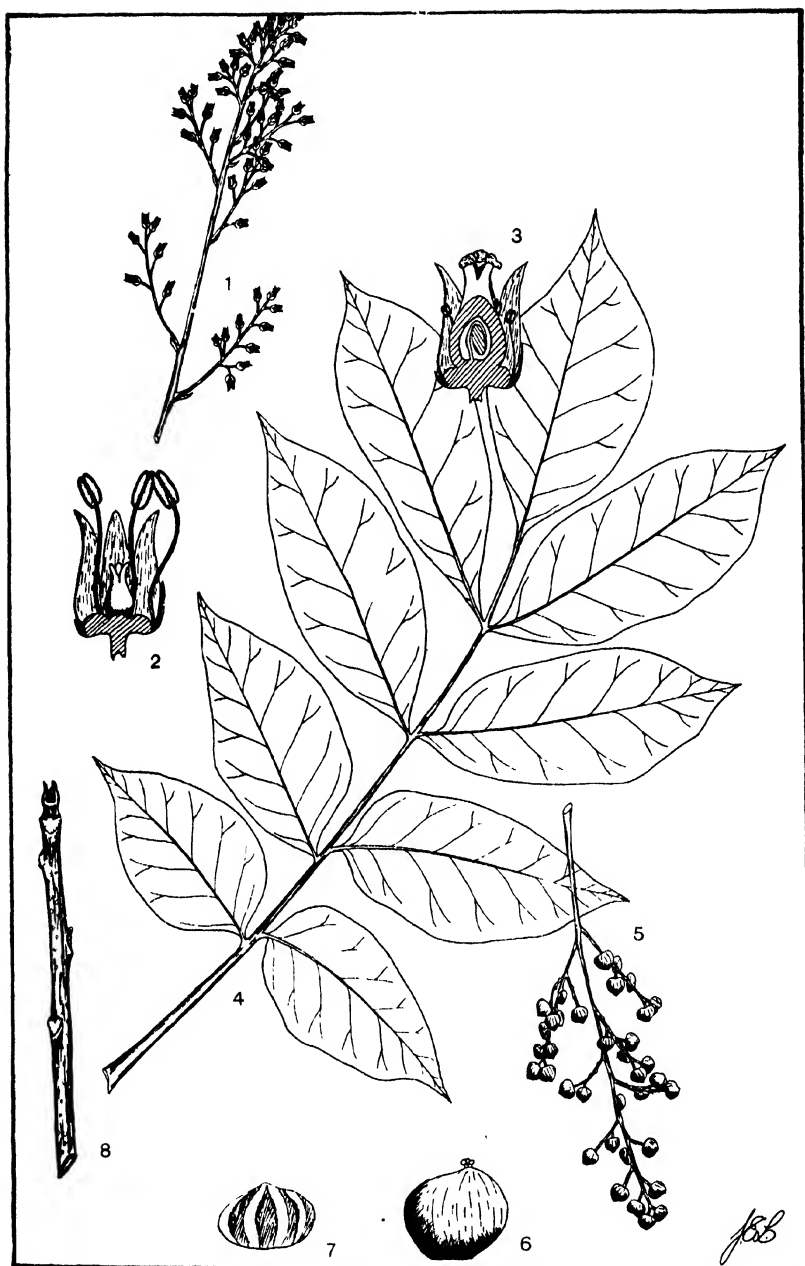
Fruit—Composed of 1–5 flat, veiny, narrowly oblong, glabrous, twisted, light reddish brown samaras. Samara $1\frac{1}{2}$ –2 inches long, about $\frac{1}{2}$ of an inch wide, rounded at the apex, tapering at the base, notched on one side and bearing the solitary seed near the middle. The samaras are borne in ample clusters on short stalks and persist on the tree into the winter and following spring.

Winter characters—Twigs very stout, blunt-pointed, yellowish to reddish brown, glabrous or finely velvety-pubescent, marked with scattered, ochre-colored lenticels, ill-smelling when crushed. Pith large, ochraceous. Terminal bud absent. Lateral buds hemi-spherical, reddish brown, pubescent, $\frac{1}{8}$ – $\frac{1}{4}$ of an inch long, usually with but 2 visible scales, located in a notch above the large leaf-scar. Mature bark thin, dark gray, slightly roughened by shallow, whitened fissures.

Habitat—A 'weed' tree growing vigorously on a variety of sites in vacant lots, about cities, and along paved streets and highways where less resistant species cannot compete owing to adverse conditions.

Range—A native of China, introduced into this country for ornamental purposes and now widely naturalized as a 'weed' tree in the Northeastern States and Ontario.

Uses—Undesirable either as a timber tree or for ornament. Wood soft, weak, coarse-grained, not durable, pale yellowish white. Objectionable as a shade or park tree because difficult to eliminate when once established, owing to its numerous root-suckers. The staminate trees should never be propagated because of the disagreeable odor of the flowers. It recommends itself only as a shade tree where urban conditions are too rigorous for other species.



Poison Sumach

Rhus vernix L. [*Rhus venenata* DC.]

- | | |
|--|---|
| 1. A pistillate inflorescence x 1 | 4. A mature leaf x $\frac{1}{2}$ |
| 2. A staminate flower, lateral section- al view x 10 | 5. Fruit-cluster x $2\frac{1}{2}$ |
| 3. A pistillate flower, lateral section- al view x 10 | 6. Drupe, lateral view x $2\frac{1}{2}$ |
| | 7. Pit, lateral view x $\frac{1}{2}$ |
| | 8. Winter twig x $\frac{1}{2}$ |

ANACARDIACEAE

Rhus vernix L. [*Rhus venenata* DC.]

Poison Sumach

Habit—A shrub or small tree 20–25 feet in height with a trunk 5–6 inches in diameter which generally divides near the ground into a number of stout, spreading limbs to form an open, rounded, bushy crown of coarse branches.

Leaves—Alternate, odd-pinnately compound, 7–14 inches long, consisting of 7–13 leaflets arranged suboppositely along a smooth, greenish red rachis. Leaflets obovate-oblong to elliptic-oblong and elliptic, 3–4 inches long, acute at the apex, cuneate and usually inequilateral at the base, entire, revolute-margined, short-petiolate aside from the terminal leaflet, at maturity coriaceous, dark green and lustrous above with scarlet midribs, paler and glabrous below. The foliage turns to brilliant shades of orange and orange-scarlet in the autumn.

Flowers—Appearing in June and July before the leaves have attained full size, dioecious, yellowish green, borne in rather narrow, drooping, axillary panicles 2½–8 inches long clustered near the tips of the twigs. Calyx 5-lobed, ovate, acute, glabrous. Disk prominent. Petals ovate-lanceolate, acute, erect. Stamens 5, exserted, with slender filaments and orange-colored anthers. Pistil consisting of an ovoid-globose, glabrous ovary surmounted by 3 short, thick, spreading styles terminating in proximate, capitate stigmas. Vestigial organs occur in flowers of both sexes.

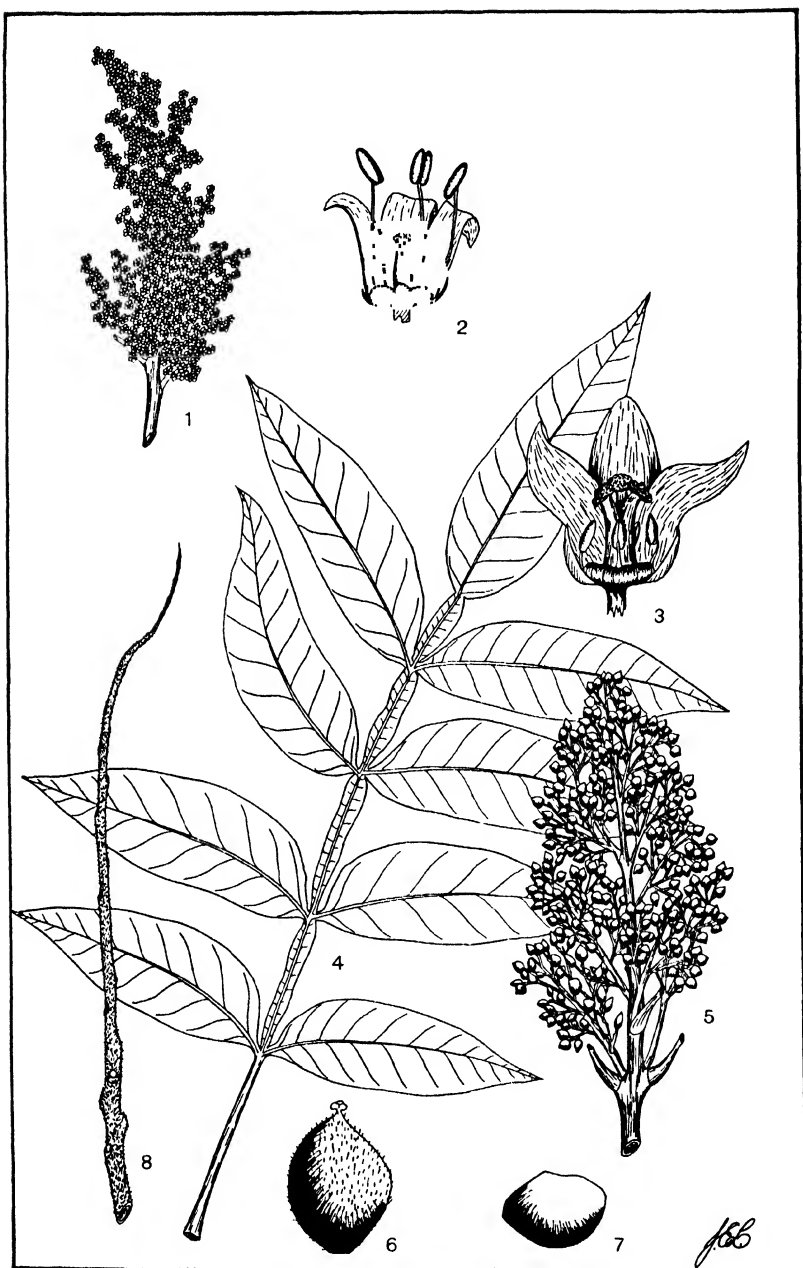
Fruit—A subglobose or broad-ovoid, slightly compressed, thin-fleshed, lustrous, ivory or tawny-white, faintly striate drupe, tipped with the style-remnants, about ½ of an inch in diameter, borne in loose, pendent, graceful clusters, ripening in September but persisting on the trees far into the winter. Pit pale yellow, thin-shelled, prominently grooved.

Winter characters—Twigs stout, glabrous, brown to orange-brown, marked by numerous, minute, raised lenticels, exuding a watery, poisonous juice when broken which turns black upon exposure, at length light gray. Pith large, yellowish brown, homogeneous. Terminal bud conical, acute, purplish, finely pubescent, ¼–½ of an inch long. Lateral buds similar but much smaller. Mature bark thin, pale light gray, smooth or somewhat striate, marked with prominent, horizontally elongated lenticels.

Habitat—In old peat bogs and cold, wet swamps which are often inundated for a portion of the year.

Range—Northern New England westward through southern Quebec and southern Ontario to southeastern Minnesota, south to Florida and Louisiana.

Uses—A poisonous species to be shunned by people susceptible to its poisonous properties. The active principle is a non-volatile oil similar to and causing the same reaction as that from Poison Ivy, *Rhus toxicodendron* L. The symptoms are acute irritation of the skin including itching, swelling, and the formation of blisters which exude a hyaline, somewhat viscid fluid when ruptured. It is recommended that the parts be scrubbed vigorously with strong yellow-soapsuds as soon after exposure as possible. More advanced stages may be relieved with an aqueous solution of baking soda or a 5% aqueous solution of potassium permanganate, applied directly to the affected parts. Where possible exposure is anticipated, a solution composed of 5 gms. ferric chloride dissolved in a mixture of 50 c.c. of glycerine and 50 c.c. of water, is recommended; this should be applied directly to the skin prior to exposure or even after exposure.



Dwarf Sumach

Rhus copallina L. [*Schmaltzia copallina* (L.) Small]

- | | |
|---|--------------------------------------|
| 1. A staminate inflorescence x $\frac{1}{2}$ | 4. A mature leaf x $\frac{1}{2}$ |
| 2. A staminate flower, lateral sectional view x 10 | 5. Fruit-cluster x $\frac{1}{2}$ |
| 3. A pistillate flower with two petals removed, lateral view x 10 | 6. Pubescent drupe, lateral view x 5 |
| | 7. Pit, lateral view x 5 |
| | 8. Winter twig x $\frac{1}{2}$ |

ANACARDIACEAE

Rhus copallina L. [*Schmaltzia copallina* (L.) Small]

Dwarf Sumach

Habit—In the North usually a shrub 5—8 feet tall, spreading by means of root-suckers, and often forming extensive copses in pastures and abandoned fields, occasionally a small tree 20—30 feet in height with a short, usually oblique trunk 8—10 inches in diameter bearing a wide-spreading crown of stout branches.

Leaves—Alternate, odd-pinnately compound, 6—12 inches long, consisting of 9—21 sessile or nearly sessile leaflets arranged in pairs along a winged rachis. Leaflets oblong-ovate to lance-ovate, $1\frac{1}{2}$ —4 inches long, acuminate at the apex, cuneate and usually inequilateral at the base, entire or remotely serrulate above the middle, at maturity thick, dark lustrous green and glabrous above except on the midrib, paler and pubescent below.

Flowers—Appearing in late June or July after the leaves are full grown, dioecious, yellowish green, borne in short, compact, pubescent, terminal or axillary panicles 4—6 inches long, the staminate panicles usually the larger. Calyx 5-lobed, the lobes ovate, acute, puberulous on the inner surface. Petals ovate, acute, greenish yellow, at anthesis reflexed above the middle. Disk red, conspicuous. Stamens 5, exserted, with slender filaments and orange-colored anthers. Pistil consisting of an ovate, pubescent ovary surmounted by 3 stout, spreading styles terminated by capitate stigmas. Vestigial organs occur in flowers of both sexes.

Fruit—An oval or slightly ovoid, somewhat compressed, thin-fleshed, crimson drupe, about $\frac{1}{8}$ of an inch in diameter, covered with close, glandular pubescence, borne in stout, pubescent clusters, ripening in the early autumn but persisting on the trees into the winter and following spring. Pit somewhat reniform, orange-brown, smooth.

Winter characters—Twigs medium stout, tapering and somewhat zig-zag, pubescent, reddish brown with prominent leaf-scars and conspicuous lenticels, exuding a watery juice when broken, usually winter-killing through several nodes. Terminal bud absent. Lateral buds small, spherical, covered with rusty-brown hairs; superposed buds present. Mature bark thin, pale reddish brown, dotted with horizontal elongated lenticels, exfoliating tardily in large, papery scales.

Habitat—Dry sandy soils on hillsides, ridges, and in abandoned fields and pastures, often forming extensive thickets, more rarely on rich bottomlands.

Range—Central Maine westward through southern Ontario and southern Michigan to eastern Nebraska, southward to Florida and Texas.

Uses—Widely used as an ornamental shrub or small tree in the parks and cemeteries of eastern United States. Prized for its dark green, lustrous leaves which turn a rich maroon in the autumn, for its small stature, and its persisting, showy fruit-clusters. Readily distinguished from the other Sumachs described in this text by the winged rachis of the leaf.



Staghorn Sumach

Rhus typhina L. [*Rhus hirta* (L.) Sudw.; *Schmalzia hirta* (L.) Small]

- | | |
|---|----------------------------------|
| 1. A staminate inflorescence x $\frac{1}{2}$ | 4. A mature leaf x $\frac{1}{2}$ |
| 2. A staminate flower, lateral sectional view x 10 | 5. Fruit-cluster x $\frac{1}{2}$ |
| 3. A pistillate flower with two petals removed, lateral view x 10 | 6. Hairy drupe x 3 |
| | 7. Pit, lateral view x 3 |
| | 8. Winter twig x $\frac{1}{2}$ |

ANACARDIACEAE

***Rhus typhina* L. [*Rhus hirta* (L.) Sudw.; *Schmaltzia hirta* (L.) Small]
Staghorn Sumach**

Habit—A small tree 25–30 feet in height with a trunk diameter of 4–8 inches, occasionally 40 feet tall with a trunk a foot in diameter, more often shrubby, spreading by means of underground shoots and forming extensive thickets. In the arborescent form, the bole is short and often inclined, and bears a low, flat crown consisting of stout, ascending, more or less contorted, irregular branches.

Leaves—Alternate, odd-pinnately compound, 1½–2 feet long, consisting of 11–31 nearly sessile leaflets arranged in pairs along a stout, hairy, reddened rachis. Leaflets lance-oblong, 2–5 inches long, acuminate at the apex, rounded or slightly cordate at the base, remotely and sharply serrate, at maturity dull dark green and quite glabrous above, paler and glabrous below aside from the midrib.

Flowers—Appearing in June or July after the leaves, dioecious (by abortion), yellowish green, borne on slender, bracteolate pedicels in dense, terminal panicles 5–12 inches long, the staminate the larger and more open. Calyx 5-lobed, the lobes lanceolate, acute, woolly without, longest in the pistillate flower. Petals 5, strap-shaped, yellowish green and reflexed at anthesis in the staminate flower, green, narrower, thickened at the apex and erect in the pistillate flower. Stamens 5, inserted on the margin of the red disk, exserted, the anthers bright orange. Pistil consisting of an ovoid, pubescent ovary, 3 short, spreading styles, and a similar number of capitate stigmas.

Fruit—A depressed-globular or hemi-spherical drupe, about ¼ of an inch in diameter, densely covered with crimson acid hairs, borne in dense panicles which persist throughout the winter. Pit somewhat reniform, orange-brown, smooth.

Winter characters—Twigs very stout, densely pubescent with olive-brown to nearly black hairs, exuding a milky juice when broken, usually winter-killing through several nodes. Lenticels orange-colored and conspicuous. Pith large, orange-colored, homogeneous. Terminal bud absent. Lateral buds conical, obtuse, protected by a dense, pale brown tomentum, nearly surrounded by the leaf-scar. Mature bark dark brown, dotted with horizontally elongated lenticels, occasionally with small, superficial scales.

Habitat—A 'weed' tree found on a variety of soils and sites along fences and highways, in pastures, and on talus slopes and cliffs, usually in dry situations, often forming copses of wide extent.

Range—New Brunswick westward through southern Canada and Minnesota to eastern North Dakota, south to Iowa and in the Appalachians to Georgia and Alabama.

Uses—Of little commercial value. Wood light, soft, golden-yellow tinged with green, with paler sapwood. Occasionally used for picture frames and nicknacks. Sometimes propagated ornamentally because of its showy autumnal foliage and fruits, and grotesque habit. Several horticultural varieties have been evolved. The twigs usually kill-back through several nodes in winter, the dead stubs persisting for a number of years. This unusual branching, 'like the horns of a stag,' coupled with the fact that the twigs are densely pubescent, 'like horns in the velvet' makes the common name, 'Staghorn Sumach' peculiarly apt.



Smooth Sumach

Rhus glabra L. [*Schmaltzia glabra* (L.) Small]

- | | |
|---|----------------------------------|
| 1. A staminate inflorescence x $\frac{1}{2}$ | 4. A mature leaf x $\frac{1}{2}$ |
| 2. A staminate flower, lateral sectional view x 10 | 5. Fruit-cluster x $\frac{1}{2}$ |
| 3. A pistillate flower with two petals removed, lateral view x 10 | 6. Drupe, lateral view x 5 |
| | 7. Pit, lateral view x 5 |
| | 8. Winter twig x $\frac{1}{2}$ |

ANACARDIACEAE

Rhus glabra L. [*Schmaltzia glabra* (L.) Small]

Smooth Sumach

Habit—Usually a low, spreading shrub, propagating by means of root-suckers and often forming extensive thickets, occasionally becoming a small tree 20—25 feet in height with a short trunk 4—5 inches in diameter which divides 3—4 feet above the ground into a number of stout, ascending branches to form a broad, flat-topped crown.

Leaves—Alternate, odd-pinnately compound, 1—3 feet long, consisting of 11—31 nearly sessile leaflets arranged suboppositely or alternately along a smooth, stout, reddish rachis. Leaflets lance-oblong, 2—5 inches long, acuminate at the apex, rounded and somewhat inequilateral at the base, sharply and remotely serrate, at maturity dark green and glabrous above, pale glaucous beneath.

Flowers—Appearing in June or July after the leaves, dioecious, yellowish green, borne in terminal panicles 5—12 inches long, the staminate panicles more open and larger than the pistillate. Calyx 5-lobed, the lobes ovate-lanceolate, acute, somewhat pubescent without, longest in the pistillate flowers. Petals ovate, acute, yellowish green. Stamens 5, inserted on the margin of the conspicuous disk, shorter than the petals. Pistil consisting of an ovoid, pubescent ovary surmounted by 3 short styles and capitate stigmas.

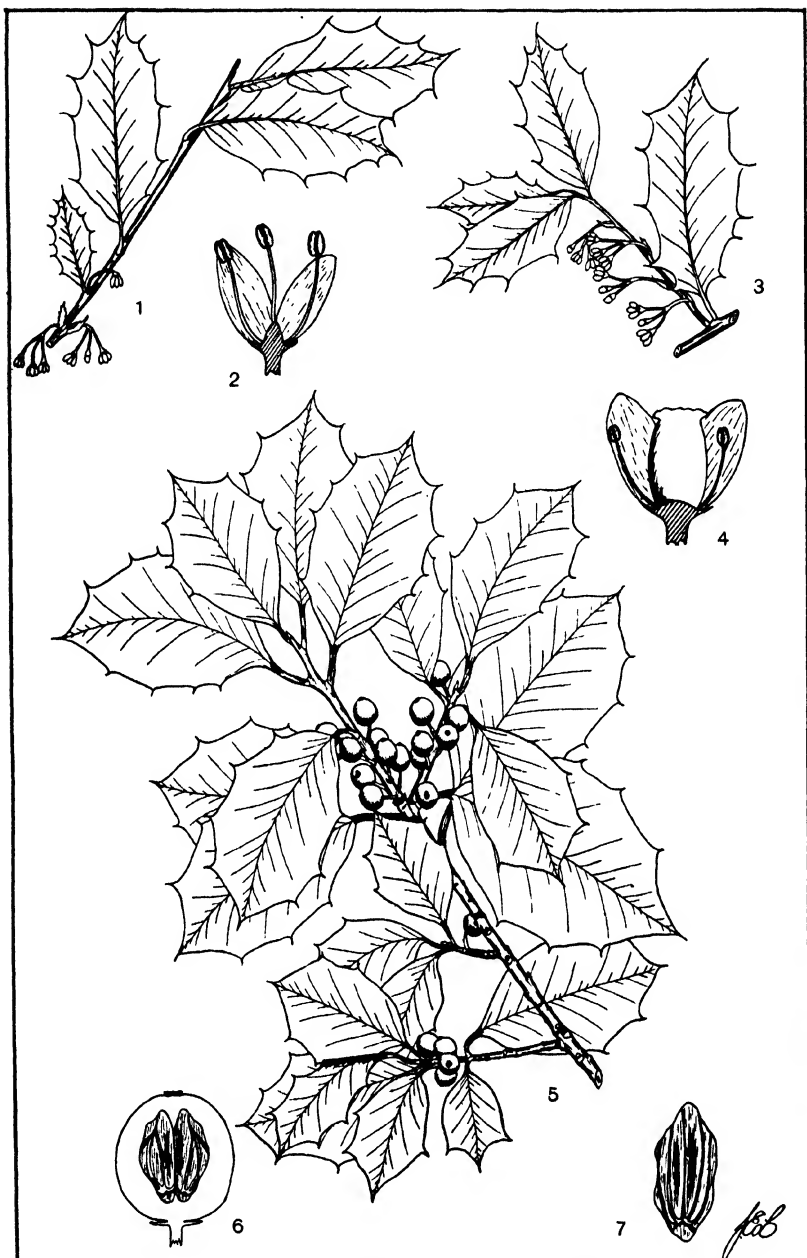
Fruit—A depressed-globular, crimson drupe, about $\frac{1}{4}$ of an inch in diameter, covered with short, close, viscid, acidulous pubescence, borne in rather open, narrow panicles, persisting on the tree into the winter and following spring. Pit ovoid, orange-brown, smooth.

Winter characters—Twigs very stout, lenticellate, pale bronze, usually glaucous and in part covered with a grayish evanescent skin, exuding a milky juice when broken, usually winter-killing through several nodes. Pith large, orange-colored, homogeneous. Terminal bud absent. Lateral bud conical, obtuse, densely covered with pale brown tomentum, nearly surrounded by the leaf-scar. Mature bark thin, gray, quite smooth.

Habitat—On a variety of sites and soils in open pastures, on hillsides and on waste ground, seeming to prefer well-drained situations, often forming thickets of considerable extent.

Range—Maine to British Columbia, south to Florida and Arizona.

Uses—The importance of this species lies in its use as an ornamental shrub. In the Northeast it is numbered among the best for mass planting. A cut-leaved form, var. *laciniata*, is widely propagated for the same purpose. Readily distinguished from the Staghorn Sumach by its more open panicles and smooth twigs.



Holly

Ilex opaca Ait.

- | | |
|---|---|
| 1. A twig showing staminate flowers x $\frac{1}{2}$ | 4. A pistillate flower, lateral section- al view x 4 |
| 2. A staminate flower, lateral section- al view x 4 | 5. A branch with mature leaves and fruit x $\frac{1}{2}$ |
| 3. A twig showing pistillate flowers x $\frac{1}{2}$ | 6. Fruit in lateral sectional view x 2 |
| | 7. Ribbed nutlet x 3 |

AQUIFOLIACEAE

Ilex opaca Ait.

Holly

Habit—A small tree 20—30 feet in height with a trunk diameter of 6—18 inches, under favorable conditions sometimes 80—100 feet tall with a trunk 2—3 (rarely 4) feet in diameter. Bole continuous through the crown. Crown compact, pyramidal, consisting of short, slender, spreading, horizontal or somewhat drooping branches bearing evergreen leaves, often extending nearly to the ground. Very shade enduring and said to be the most tolerant tree of the South. Can be propagated by 'cuttings.'

Leaves—Alternate, elliptic to obovate-oblong, 2—4 inches long, pungently acute at the apex, broadly cuneate at the base, with thickened undulate margins and rather distant spinose teeth or occasionally entire, at maturity thick, coriaceous, dull yellow-green, glabrous and centrally grooved above, paler and smooth beneath, borne on short, stout petioles thickened at the base.

Flowers—Appearing in late May and June in the Northeast, small, dioecious, axillary on slender, puberulous, bracteolate pedicels, the staminate in 3—9-flowered cymes, the pistillate singly or 2—3 together. Calyx minute, 4—6-lobed, the lobes triangular, acute, ciliate, persistent. Petals 4—6, oblong, obtuse, greenish white, about $\frac{1}{2}$ of an inch long. Stamens 4—6, alternate with the petals, exserted, with subulate filaments and oblong anthers. Pistil consisting of a sessile, subcylindrical, 4—6-celled ovary and sessile, usually confluent stigmas which persist in fruit.

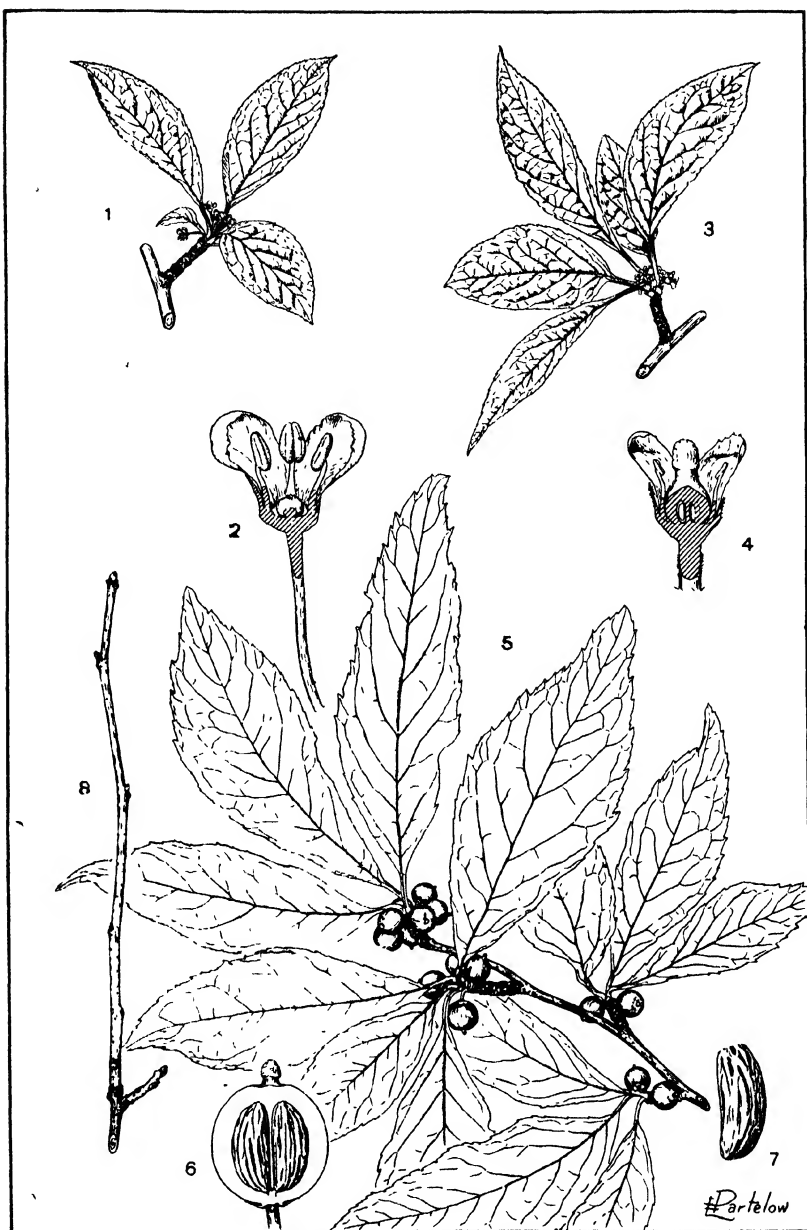
Fruit—A spherical or ovoid, glabrous, dull red or occasionally yellow drupe, about $\frac{3}{4}$ of an inch in diameter, subtended by the persistent calyx, usually borne solitary on short, stout stalks, ripening in the autumn but remaining on the branches until the following spring. Nutlets light brown, prominently few-ribbed on the back.

Winter characters—Leaves persisting on the twig about three years, turning yellowish green during the winter months. Twigs rather stout, glabrous, pale brown, with inconspicuous lenticels. Buds short, the terminal acute, the lateral obtuse and somewhat downy. Mature bark grayish white, roughened by warty excrescences, about $\frac{1}{2}$ of an inch thick.

Habitat—Prefers moist sites on the borders of swamps and on rich bottomlands but will persist on drier soils in protected situations. Along the coast it is frequently found growing behind the protecting sand dunes.

Range—Coastal region from Massachusetts to Florida and eastern Texas, extending north in the Mississippi Basin to southern Illinois and southern Indiana. Exceedingly rare at higher elevations in the interior. Spread by the agency of birds.

Uses—The sprays of evergreen leaves and bright berries (drupes) are used in immense quantities for holiday decoration and the species should be protected by law to prevent extinction. The tree possesses ornamental value but is not used extensively for this purpose because of its slow growth. It is especially resistant to salt spray and is hence suitable for planting along the coast. Wood light, tough, rather weak, close-grained, ivory-white when first cut, turning brown with exposure. Used for umbrella handles, for turnery of all sorts, and in the manufacture of souvenirs and nicknacks.



Large-leaved Holly, Mountain Holly

Ilex dubia (Don) B. S. P., var. *monticola* (Gray) Loes. [*Ilex montana* Torr. et Gray; *Ilex monticola* Gray].

1. A twig showing staminate flowers $\times \frac{1}{2}$
2. A staminate flower, lateral sectional view $\times 4$
3. A twig showing pistillate flowers $\times \frac{1}{2}$
4. A pistillate flower, lateral sectional view $\times 4$
5. A branch with mature leaves and fruit $\times \frac{1}{2}$
6. Fruit in lateral sectional view $\times 2$
7. Ribbed nutlet $\times 3$
8. Winter twig $\times \frac{1}{2}$

AQUIFOLIACEAE

Ilex dubia (Don) B. S. P., var. **monticola** (Gray) Loes. [*Ilex montana* Torr. et Gray; *Ilex monticola* Gray].

Large-leaved Holly, Mountain Holly

Habit—Occasionally a tree attaining a height of 30—40 feet with a trunk 10—12 inches in diameter, in New York State a shrub or small tree usually less than 20 feet in height. In the arborescent form the trunk is short and supports a rather wide, deep crown of slender, ascending branches.

Leaves—Alternate, ovate to oblong-lanceolate, $1\frac{3}{4}$ ths—5 inches long, $\frac{1}{2}$ — $2\frac{3}{4}$ ths inches broad, acute or acuminate at the apex, narrow- or broad-cuneate at the base, sharply serrate with gland-tipped teeth, at maturity membranous, dark green and glabrous above, paler and glabrous or sparingly hairy on the prominent veins below, borne on petioles $\frac{1}{3}$ — $\frac{2}{3}$ rds of an inch long.

Flowers—Appearing in June and early July when the leaves are nearly fully grown, small, dioecious, in 1—2-flowered cymes aggregated at the ends of lateral spur-like branches of the preceding year or solitary on the shoots of the season, the staminate on slender pedicels $\frac{1}{2}$ of an inch long, the pistillate on much shorter pedicels. Calyx-tube $\frac{1}{4}$ — $\frac{1}{2}$ of an inch in diameter, with 3—5 broadly triangular, acute, irregularly toothed, ciliate-margined lobes. Corolla white, $\frac{1}{4}$ — $\frac{1}{3}$ rd of an inch in diameter, composed of 3—5 oval to obovate, rounded, spreading petals which cohere slightly at the base. Stamens 3—5, alternate with the petals, exserted, with subulate filaments and oblong anthers, reduced to staminodia in the fertile flowers. Pistil shaped like a bowling pin, consisting of a sessile, 3—5-celled ovary capped by a broad, sessile stigma.

Fruit—A globose, glabrous, bright scarlet drupe, about $\frac{3}{4}$ ths of an inch in diameter, subtended by the persistent calyx and crowned by the remnants of the large stigma, usually borne solitary on short, stout stalks about $\frac{1}{4}$ of an inch long, ripening in the early autumn; nutlets narrowed at the ends, prominently ribbed on the sides and back.

Winter characters—Twigs slender, more or less zigzag, smooth, with decurrent ridges running down from the leaf scars, reddish brown with whitish, scattered lenticels, at length dark gray. Short spur-like branches numerous. Buds light brown, broadly ovate to globular, obtuse, about $\frac{1}{8}$ th of an inch long. Terminal bud present. Lateral buds often superposed. Bud-scales ovate, keeled, apiculate, finely hairy toward the apex. Bark light brown, sprinkled with persisting whitish lenticels, very thin.

Habitat—Prefers rich, damp, often rocky sites on high, wooded hills and in mountain forests. Tolerant of shade and often found growing under the dense canopy of larger trees.

Range—Western Massachusetts and New York southward along the Alleghenies to Georgia and Alabama. In New York state, reported as occurring in the Taconic and Catskill mountains, and at various places on the high hills of the central New York plateau.

Uses—Of little importance in forestry. The most ornamental of the deciduous-leaved hollies and occasionally grown for its large, brilliant fruit and ample foliage.



Box-Elder, Ash-leaved Maple

Acer negundo L. [*Negundo aceroides* Moench.; *Negundo fraxinifolium* Nutt.]

- | | |
|---|--|
| 1. A twig showing staminate flowers and opening leaf-buds x $\frac{1}{2}$ | 4. A pistillate flower, lateral view x 2 |
| 2. A staminate flower, lateral view x 3 | 5. A mature leaf x $\frac{1}{2}$ |
| 3. A twig showing pistillate flowers and immature leaves x $\frac{1}{2}$ | 6. Portion of twig with fruit-clusters x $\frac{1}{2}$ |
| | 7. Winter twig x $\frac{1}{2}$ |

ACERACEAE

Acer negundo L. [*Negundo aceroides* Moench.; *Negundo fraxinifolium* Nutt.]

Box-Elder, Ash-leaved Maple

Habit—Usually a medium-sized tree 40—50 feet in height, under favorable conditions sometimes 50—75 feet tall with a trunk 2—4 feet in diameter. Bole usually short, dividing low down into stout, spreading limbs to form a broad, rounded, bushy crown, occasionally long and free of branches for some distance. A short-lived species prone to fungal decay. Sprouts readily from the stump. Drought-resisting.

Leaves—Opposite, odd-pinnately compound or in part decomposed, 6—15 inches long, long-petioled, consisting of 3—5 (rarely 7 or 9) leaflets. Leaflets ovate to elliptic and obovate, acuminate at the apex, cuncate or rounded and often unsymmetrical at the base, coarsely and irregularly serrate usually only above the middle or nearly entire or variously lobulate, the terminal leaflet frequently 3-lobed, at maturity thin, light green, glabrous or somewhat pubescent above, paler and nearly smooth below, borne on stout petiolules, that of the terminal leaflet often 1 inch long.

Flowers—Appearing in April or May with or before the leaves on the growth of the preceding season, yellowish green, dioecious, the staminate in fascicles with long, pendulous pedicels 1—2 inches long, the pistillate in narrow, drooping racemes. Calyx hairy without, campanulate and obscurely 5-lobed in the staminate flower, tubular and deeply lobed in the pistillate flower. Corolla wanting. Stamens 4—6, exserted, with slender filaments and elongated anthers. Pistil consisting of a short, compressed, pubescent, laterally lobed ovary surmounted by 2 elongated styles which are stigmatic along the inner surface.

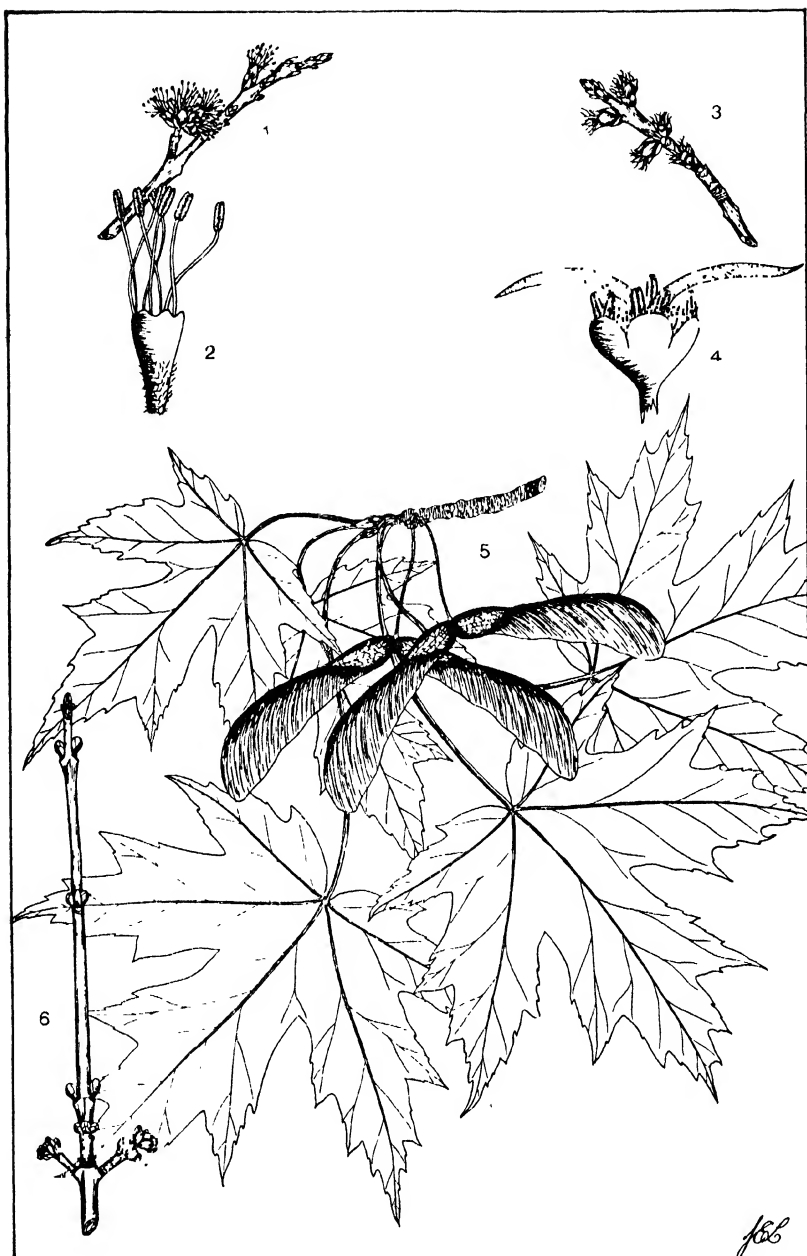
Fruit—A glabrous, double samara consisting of 2 pale, reddish brown, acutely diverging, 1-seeded carpels $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, bearing thin, reticulately veined, straight or somewhat falcate wings $1\frac{1}{2}$ —2 inches long, borne in drooping racemes, ripening in the autumn and separating from the fruit stalks which persist on the twigs during the winter.

Winter characters—Twigs stout, green or purplish green, smooth, lustrous or covered at least toward the tips with a glaucous bloom, marked by scattered, pale lenticels. Terminal bud ovoid, acute, pale tomentose, about $\frac{1}{8}$ of an inch long. Lateral buds opposite, short-stalked, obtuse, shorter than the terminal bud, nearly or quite enclosed by the first pair of bud-scales which commonly bear lateral accessory-buds in their axils. Mature bark thin, pale gray or light brown, shallowly fissured with narrow, anastomosing ridges.

Habitat—A moisture-loving species preferring the banks of streams and rivers, margins of lakes, and low bottomlands in company with other hardwoods. It is often planted and will thrive in drier situations.

Range—Typical form: Western New England and northern New York westward to Minnesota, south to central Florida and in the West through eastern Kansas and eastern Oklahoma to eastern Texas.

Uses—Of little commercial importance as a timber tree. Wood soft, light, not strong, close-grained, creamy white. Occasionally manufactured into cheap furniture and woodenware and used for coopers and fuel, etc. The 'true species' possesses little ornamental value owing to its bushy, scraggy crown and short life. A number of horticultural and wild varieties are recognized; the former are planted extensively in the East as shade, lawn, and roadside trees. *Acer negundo* var. *californicum* Sarg. is very hardy and drought-resisting, and is much planted in the Northwest for shelter belts.



Silver Maple, White Maple

Acer saccharinum L. [*Acer dasycarpum* Ehrh.]

1. A twig showing staminate flowers and unopened leaf-buds $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 10$
3. A twig showing pistillate flowers and unopened leaf-buds $\times \frac{1}{2}$
4. A pistillate flower, lateral view $\times 8$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

ACERACEAE

Acer saccharinum L. [*Acer dasycarpum* Ehrh.]

Silver Maple, White Maple

Habit—A large tree 60—80 feet in height with a trunk diameter of 2—4 feet, under favorable conditions sometimes 120 feet tall and 5 feet through at the butt. Bole usually short, dividing 10—15 feet above the ground into several stout, ascending limbs which ultimately bear brittle, pendulous branches and form a broad-topped, rounded crown. Fairly tolerant (less so than Sugar Maple). Sprouts vigorously from the stump.

Leaves—Opposite, nearly orbicular, 6—7 inches across, cordate or truncate at the base, palmately 5-nerved and deeply 5-lobed, the lateral lobes acuminate, coarsely and irregularly dentate, and separated by acute sinuses, the terminal lobe usually with three divergent secondary lobes. At maturity the leaves are thin, pale green and glabrous above, silvery-glaucous beneath, and are borne on slender, drooping, red petioles 4—5 inches long.

Flowers—Appearing during the first warm days of March and April before the leaves in dense, sessile, axillary clusters on the growth of the preceding season, greenish yellow, polygamous, the staminate and pistillate in separate clusters on the same or on different trees. Calyx tubular in the staminate flower, urn-shaped in the pistillate flower, shallowly 5-lobed, usually pubescent without. Corolla lacking. Stamens 3—7, long-exserted in the staminate flower, with slender filaments and red anthers. Pistil consisting of a short, compressed, pubescent, 2-lobed ovary surmounted by 2 widely divergent styles with stigmatic tips.

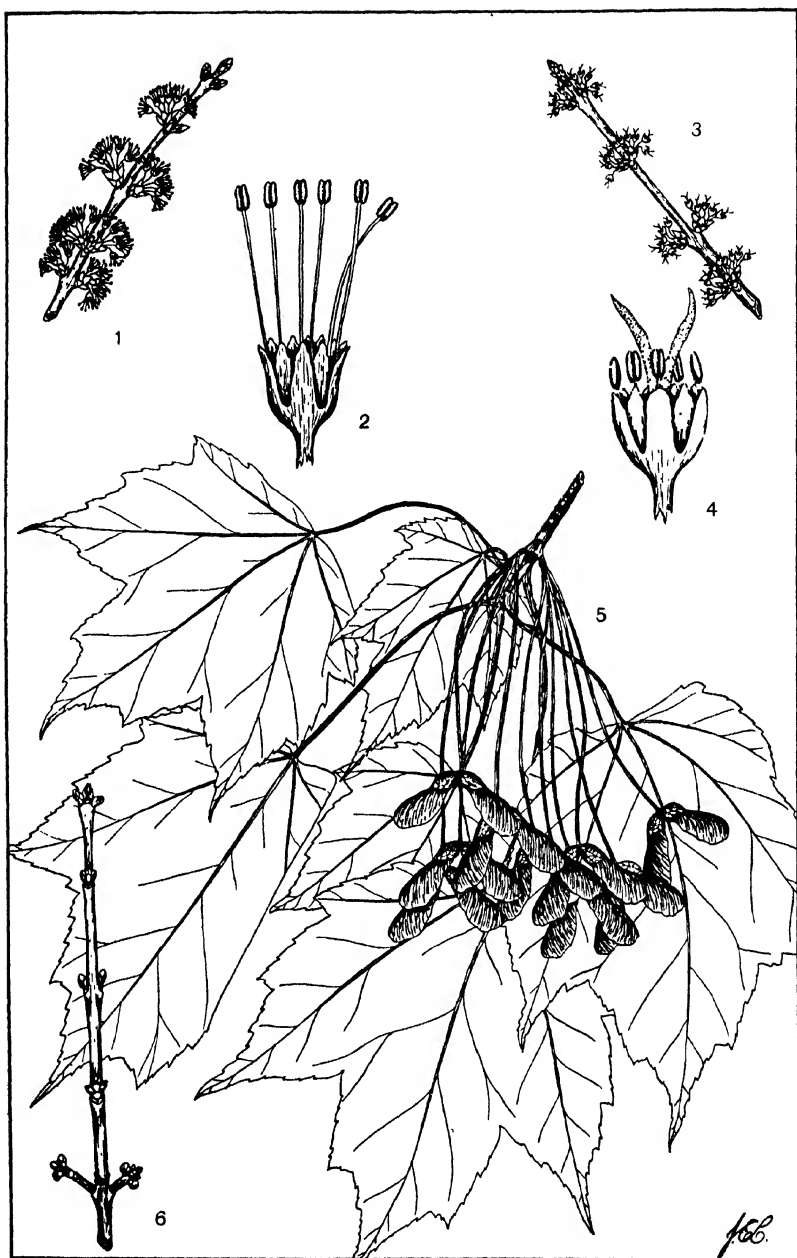
Fruit—A glabrous, double samara consisting of 2 pale, reddish brown and wrinkled, laterally compressed, 1-seeded carpels about $\frac{1}{2}$ of an inch long bearing from the back straight or somewhat falcate, widely divergent wings 1—2 inches long, borne on slender, drooping stalks. The samaras mature in April and May and the seeds germinate as soon as they fall to the ground.

Winter characters—Twigs rather slender, lustrous, conspicuously lenticellate, light chestnut-brown becoming paler the second season. When freshly cut or broken, the twigs exhale a rank odor. Terminal bud ovate-oval, obtuse, red, about $\frac{1}{4}$ of an inch long, covered with 3—4 pairs of visible scales which are rounded and ciliate on the margin. Lateral leaf-buds similar, short-stalked, usually accompanied by globose flower-buds on either side which are larger and more conspicuous than the true axillary bud. Mature bark thin, reddish brown, separating at the surface into elongated, loose, longitudinal plates giving the tree a shaggy appearance, that of young trunks and branches smooth and light gray.

Habitat—Typically a bottomland species preferring moist situations along sluggish streams and the borders of swamps where the soil is often inundated for a part of each year. Occasionally in groves, commonly mixed with other moisture-loving species. Propagated for shade and ornament in drier soils.

Range—New Brunswick through southern Ontario and southern Michigan to southeastern South Dakota, south to western Florida and in the West through eastern Nebraska, Kansas and eastern Oklahoma to southwestern Arkansas and western Louisiana.

Uses—The chief value of the species lies in its use as an ornamental and shade tree, a number of horticultural varieties being recognized. A comparatively short-lived tree which should not be planted in exposed situations as the branches are brittle and subject to storm injury and decay. Wood medium hard, medium heavy, strong, brittle, close-grained, pale brown with thick, paler sapwood. With Red Maple, *Acer rubrum* L., supplying the 'soft maple' of the eastern trade. Used for cheap furniture and occasionally for flooring.



Red Maple, Swamp Maple

Acer rubrum L.

1. A twig showing staminate flowers and unopened leaf-buds x $\frac{1}{2}$
2. A staminate flower, lateral view x 5
3. A twig showing pistillate flowers and unopened leaf-buds x $\frac{1}{2}$
4. A pistillate flower, lateral view x 5
5. A branch showing mature leaves and fruit x $\frac{1}{2}$
6. Winter twig x $\frac{1}{2}$

ACERACEAE
Acer rubrum L.*

Red Maple, Swamp Maple

Habit—Generally a medium-sized tree 40—50 feet in height with a trunk diameter of 1—2 feet, under favorable conditions occasionally becoming 80—120 feet tall with a trunk up to $4\frac{1}{2}$ feet in diameter. In the open the bole is usually 6—10 feet long and branches low down into stout, spreading, upright and horizontal branches to form a compact, narrow, oblong or obovoid head. Under forest conditions the bole is much longer and bears a restricted crown. Like the Silver Maple, Red Maple is fairly tolerant and sprouts readily from the stump.

Leaves—Opposite, orbicular or obovate, 2—6 inches long, truncate or subcordate at the base, palmately 3—5-nerved and lobed, the lobes acute or acuminate, irregularly doubly serrate and separated by shallow, acute sinuses. At maturity the leaves are light green and glabrous above, pale greenish white and glabrous below aside from the prominent veins, and are borne on slender, red or green petioles 2—4 inches long.

Flowers—Appearing in March and April in advance of the leaves in dense, sessile, axillary clusters on the growth of the preceding season, scarlet or yellowish red, polygamous, pedicellate, the staminate and pistillate in separate clusters on the same or on different trees. Calyx campanulate, deeply 5-lobed, the lobes oblong and obtuse. Petals 5, oblong or linear, equaling the calyx-lobes. Stamens 5—8, exerted in the staminate flowers, with slender filaments and scarlet anthers. Pistil consisting of a glabrous, compressed, laterally lobed ovary and 2 widely divergent styles which bear elongated stigmatic lobes. The flowers can be distinguished from those of Silver Maple by the presence of a corolla.

Fruit—A glabrous, scarlet or reddish brown, double samara consisting of 2 somewhat striate, laterally compressed, seed-like carpels about $\frac{1}{4}$ of an inch long bearing from the back thin, erect, divergent wings $\frac{1}{2}$ —1 inch long, borne in clusters on drooping stalks 3—4 inches long. The samaras mature in May and June and the seeds usually germinate at once.

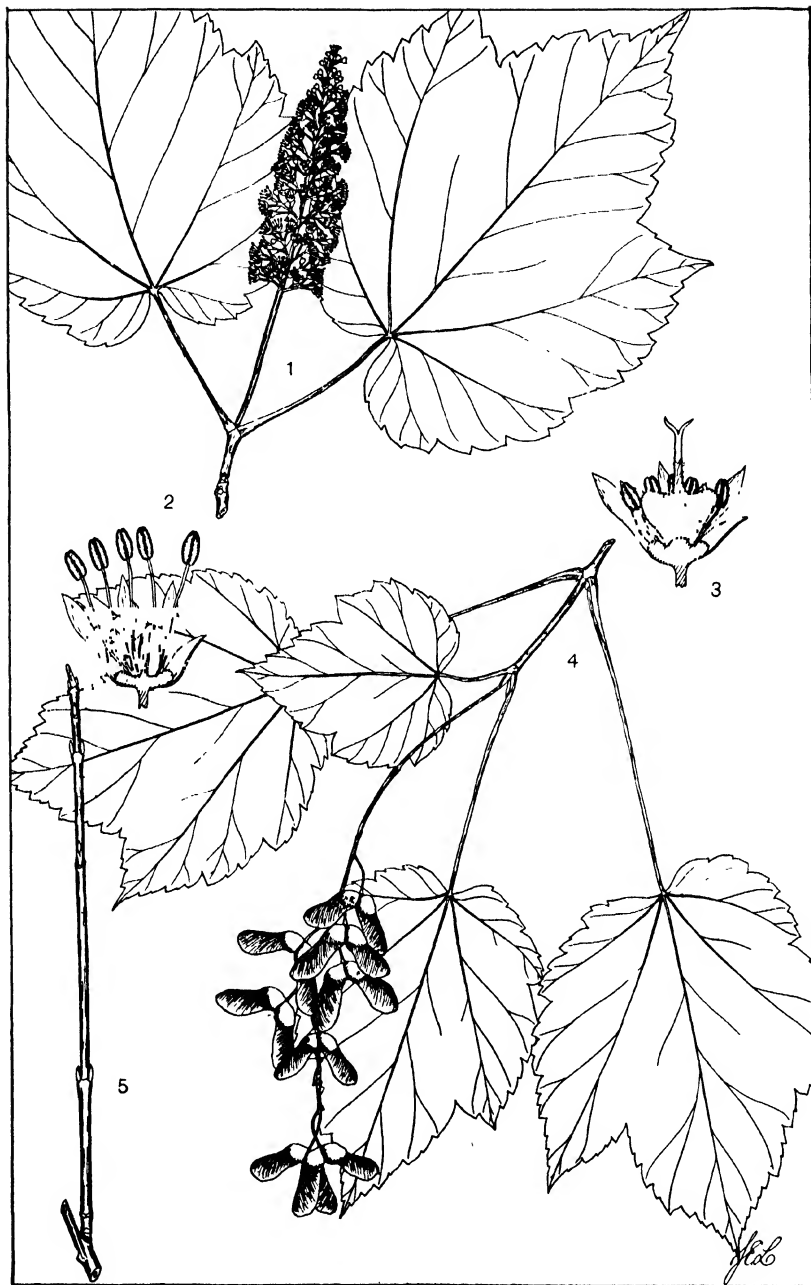
Winter characters—Twigs rather slender, lustrous, pale-lenticellate, light or dark red, at length gray tinged with red, odorless when crushed. Lateral leaf-buds opposite, oval-ovate, obtuse, red, short-stalked, about $\frac{1}{2}$ of an inch long, covered with 3—4 pairs of visible scales which are rounded and ciliate on the margins. Terminal bud similar but slightly larger. Flower-buds numerous, stout, collateral, usually one on either side of the leaf-bud. Mature bark thin, dark gray, divided by shallow fissures into long, longitudinal ridges which separate into long plates at the surface giving the tree a shaggy appearance, that of young trunks and branches smooth and light gray, resembling Beech.

Habitat—Typically a bottomland species inhabiting and attaining its best development on river banks and low, wet sites in company with Cypress, Black Ash, Red Gum, Pepperidge, etc., or often occupying such sites to the exclusion of other species. It also frequents higher ground, often forming an important part of the forest in hilly areas in company with other species.

Range—Newfoundland westward through southern Canada to Minnesota, south to Florida, Oklahoma, and Texas.

Uses—Of ornamental value because of its foliage which is whitened beneath and turns red or scarlet in the autumn. A number of varieties are recognized. Recommended for roadside and park planting but is not sufficiently hardy for city streets. Wood medium hard, medium heavy, not strong, close-grained, light brown often with a roseate cast, with thick paler sapwood. Intermixed with Silver Maple and sold as 'soft maple' in the trade. Used for cheap furniture, flooring, turnery, woodenware, etc.

**Acer rubrum* var. *tridens* Wood is reported as occurring in central New England and southern New York, and southward. This form differs from the true species in possessing smaller leaves which are 3-lobed near the apex, rounded or broad-cuneate at the base, and usually pubescent beneath.



Mountain Maple

Acer spicatum Lam.

1. A flowering branch $\times \frac{1}{2}$
2. A staminate flower, lateral sectional view $\times 5$
3. A pistillate flower, lateral sectional view $\times 5$
4. A fruiting branch $\times \frac{1}{2}$
5. Winter twig $\times \frac{1}{2}$

ACERACEAE
***Acer spicatum* Lam.**

Mountain Maple

Habit—Occasionally a small bushy tree 20—35 feet in height with a trunk diameter of 4—8 inches, more often a shrub growing in clumps of a half dozen or more, or forming extensive thickets. A tolerant species by preference but withstanding more sunlight than Striped Maple.

Leaves—Opposite, broad-ovate to orbicular, 3—5 inches long, cordate at the base, palmately 3-lobed or obscurely 5-lobed, the lobes acute or acuminate at the apex and coarsely crenate-serrate with gland-tipped teeth. At maturity the leaves are membranous, prominently 3-nerved with conspicuous veinlets, glabrous above, dense hoary pubescent below, borne on slender petioles 2—3 inches long which are enlarged at the base and usually turn scarlet during the summer.

Flowers—Appearing in June when the leaves are nearly full grown, polygamo-dioecious, greenish yellow, borne in narrow, erect, terminal, pubescent, long-stalked, slightly compound racemes, the fertile flowers towards the base. Calyx usually 5-lobed, the lobes narrowly obovate, pubescent on the outer surface. Petals usually 5, linear-spatulate, acute, longer than the sepals. Stamens 7—8, free, with slender, glabrous filaments and oblong, glandular anthers, exserted in the staminate flower. Pistil consisting of a sessile, broadly obovate, laterally compressed, pale tomentose ovary surmounted by a columnar style and 2 short, spreading stigmas.

Fruit—A double samara consisting of 2 bright red, 1-seeded, laterally compressed, nearly glabrous, strongly striated, nut-like carpels which develop from the back oblong or obovate, coriaceous, divergent wings about $\frac{1}{2}$ of an inch long. The samaras are borne in drooping, racemose clusters. As they mature in September, the nut-like carpels turn brown and fall separately from the persisting axis.

Winter characters—Twigs slender, bright red, appressed-grayish-pubescent at least toward the tip, at length pale grayish brown, often streaked with green toward the base. Buds opposite, acute, appressed, short-stalked, greenish red, about $\frac{1}{4}$ of an inch long including the stalk. Terminal bud larger. Bud-scales 2—3 pairs (one or two pairs visible), the inner pair tomentose. Mature bark thin, reddish brown, smooth or slightly furrowed.

Habitat—Prefers moist shady sites in rocky glens, gulfs, and on talus slopes with northern exposure. Frequent on the moist alpine slopes of the southern Appalachian Mountains.

Range—Newfoundland and Labrador to Hudson Bay and Saskatchewan, in the northern border states to Minnesota, extending south to Iowa and in the Appalachians to Georgia and eastern Tennessee.

Uses—This species possesses little economic importance. Occasionally cultivated for ornament in arboretums and parks. The wood is sometimes used for fuel.



Striped Maple, Moosewood

Acer pennsylvanicum L. [*Acer striatum* Lam.]

1. A flowering branch $\times \frac{1}{2}$
2. A staminate flower, lateral sectional view $\times 10$
3. A pistillate flower, lateral sectional view $\times 10$
4. A fruiting branch $\times \frac{1}{2}$
5. Winter twig $\times \frac{1}{2}$

ACERACEAE

Acer pennsylvanicum L. [*Acer striatum* Lam.]

Striped Maple, Moosewood

Habit—Usually a large shrub or small tree 10—25 feet in height with a trunk-diameter of 2—6 inches, occasionally 30—40 feet in height with a trunk 8—10 inches in diameter. Trunk usually short, dividing a few feet above the ground into slender, straight, ascending branches which form a deep, broad crown, often several stems together. A very tolerant species, avoiding excessive or prolonged insolation.

Leaves—Opposite, broadly obovate to orbicular, 4—6 inches long, 4—5 inches wide, cordate or rounded at the base, palmately 3-nerved and acutely 3-lobed at the apex and occasionally with 2 short additional lobes at the base, sharply and finely doubly serrate, at maturity membranous, pale green and glabrous above, paler and nearly smooth beneath, borne on stout, grooved petioles which are enlarged at the base and $1\frac{1}{2}$ —2 inches long.

Flowers—Appearing in May and June when the leaves are nearly full grown, dioecious or occasionally the two sorts on the same plant, yellowish green, borne in terminal, drooping, stalked racemes 4—6 inches long. Sepals linear-lanceolate, yellowish green, about $\frac{1}{4}$ of an inch long. Petals obovate to spatulate, bright yellow, slightly longer than the sepals. Stamens 7—8, shorter than the petals, with slender filaments and oval anthers. Pistil consisting of a sessile, broadly obovate, laterally compressed, purplish brown, puberulous ovary surmounted by a stout style and 2 spreading, recurved stigmas. Vestigial organs present in both types of flowers.

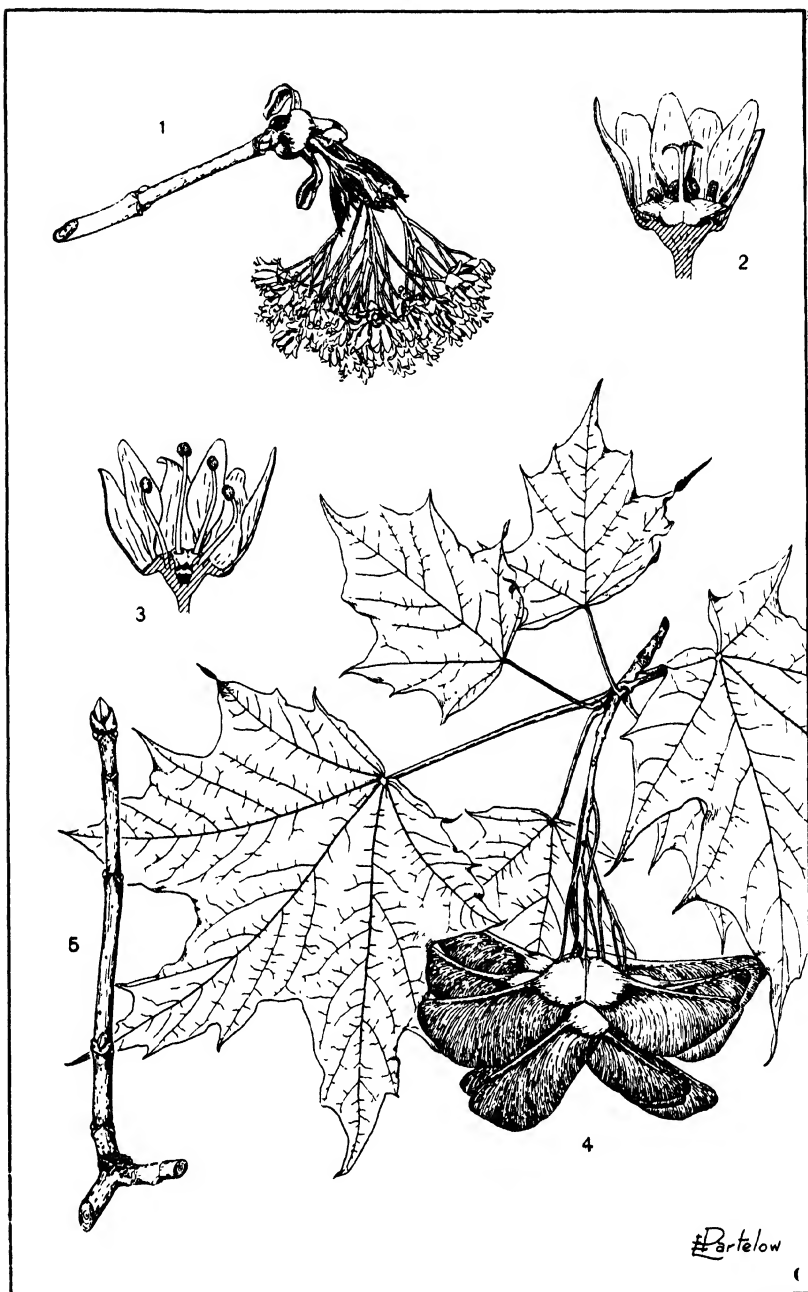
Fruit—A double samara consisting of two dark reddish brown, 1-seeded, laterally-compressed and somewhat rugose, nut-like carpels, each about $\frac{1}{4}$ of an inch long and bearing on its back a thin, oblong to obovate, divergent wing about $\frac{3}{4}$ of an inch long. Fruiting racemes glabrous, drooping, 4—6 inches long.

Winter characters—Twigs stout, glabrous, reddish brown, with scattered, inconspicuous lenticels and brown pith. Buds opposite, obtuse, somewhat 4-sided, appressed, short-stalked, about $\frac{1}{3}$ of an inch long, entirely covered by single pair of red, smooth, valvate scales. Terminal bud larger than the appressed lateral buds. Mature bark thin, quite smooth, green or reddish brown, conspicuously marked longitudinally by white streaks, at length becoming dark gray and rougher.

Habitat—Shaded situations in cool, moist woods, deep glens, and on northern exposures where it is protected from excessive insolation. Forms the bulk of the shrubby undergrowth in many places.

Range—Quebec along the shores of Lake Ontario and the islands of Lake Huron to northern Wisconsin, southward into the Northern and North Atlantic States and in the mountains to northern Georgia.

Uses—Of no economic importance. The tree possesses ornamental value and is occasionally grown in the larger parks of the Northeastern States but its exacting site requirements preclude its extensive use. The common name, Striped Maple, refers to the conspicuous, longitudinal, white streaks in the bark.



Norway Maple
***Acer platanoides* L.**

- | | |
|--|--|
| 1. A twig-tip showing staminate flowers $\times \frac{1}{2}$ | 3. A staminate flower, lateral sectional view $\times 2$ |
| 2. A perfect flower, lateral sectional view $\times 2$ | 4. A fruiting branch $\times \frac{1}{2}$ |
| | 5. Winter twig $\times \frac{1}{2}$ |

ACERACEAE
Acer platanoides L.
Norway Maple

Habit—A handsome tree, usually 30—60 feet in height with a short trunk 4—10 feet in length which supports a low, broad, globose crown of dense foliage, in western Europe sometimes reaching a height of 90 feet or more.

Leaves—Opposite, orbicular or nearly so, 4—7 inches in diameter, cordate or nearly truncate at the base, palmately 5—7 (usually 7) -nerved and -lobed, the lobes acuminate, sparingly sinuately toothed and separated by rounded sinuses. At maturity the leaves are membranous, dark yellowish green and glabrous above, bright lustrous green and with tufts of hairs in the axils of the veins below, and are borne on slender petioles $1\frac{1}{2}$ to 6 inches in length which exude a milky juice when broken. The dense foliage clings on the tree in the autumn longer than that of our native Maples.

Flowers—Appearing in April and May before the leaves, greenish yellow, polygamous and those on a single tree either all staminate, all pistillate, or all bisexual, borne in erect, many-flowered, rounded, stalked corymbs from terminal mixed-buds. Sepals 5, oblong, shallowly indented at the apex, inserted with the petals on the margin of a broad, thick, perigynous, shallowly lobed disk. Corolla $\frac{1}{2}$ of an inch across, consisting of 5 ovate, short-clawed petals which alternate with the sepals. Stamens generally 8, inserted in pits on the summit of the disk, those in the staminate flowers with filiform filaments and short-oblong anthers and exserted, those in the pistillate flowers shorter and generally abortive. Pistil consisting of a glabrous, lustrous, broadly laterally lobed, compressed ovary surmounted by a style bearing two, widely divergent, stigmatic lobes at the apex.

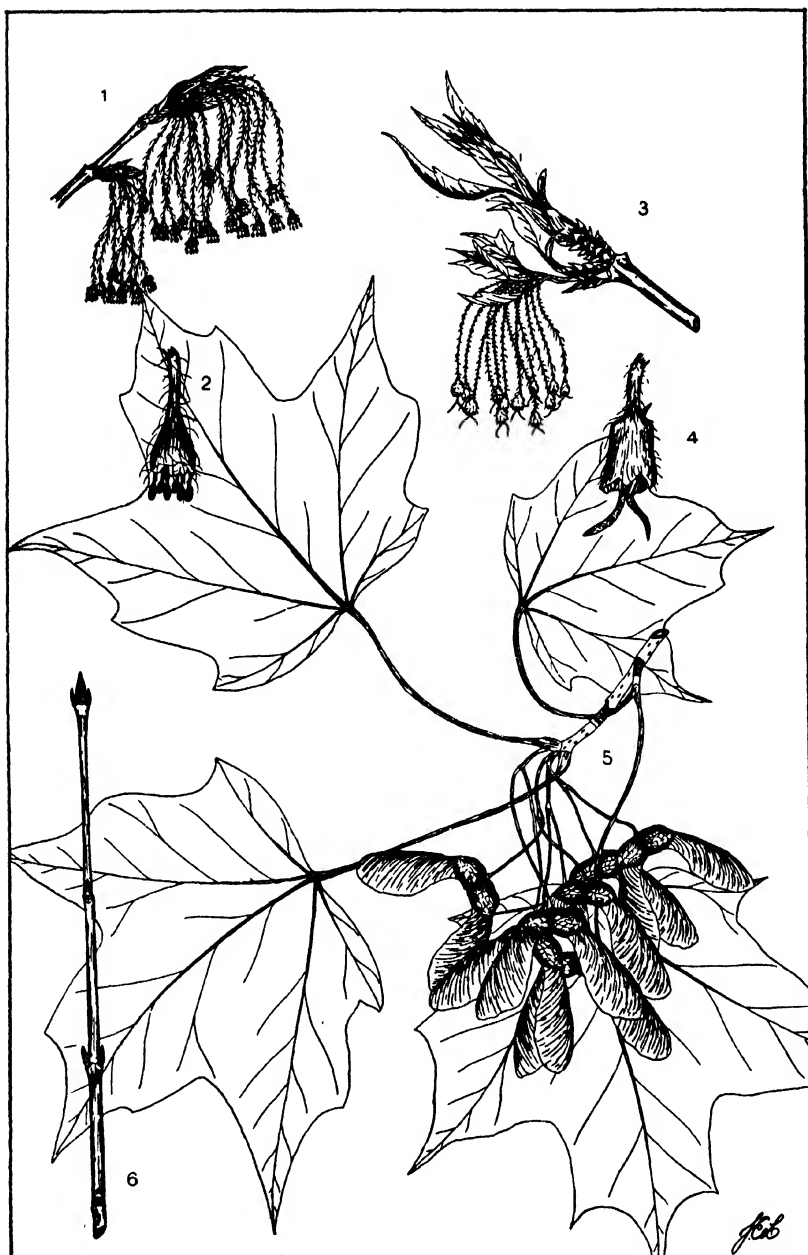
Fruit—A glabrous, pendulous, double samara consisting of 2 light straw-brown, laterally compressed, 1-seeded carpels $\frac{3}{4}$ th— $\frac{1}{2}$ ths of an inch long, equipped on the back with a broad, thin, nearly horizontally spreading wing $1\frac{1}{4}$ th—2 inches long (including the seminal portion). The samaras are borne in clusters on long, smooth, filamentous stalks and at maturity break into two closed, 1-winged, 1-seeded half-fruits.

Winter characters—Twigs rather stout, brown to greenish or yellowish brown, smooth, lustrous, marked with a few grayish lenticels, turning gray the second season and developing fine, irregular, longitudinal cracks. Buds reddish or yellowish green toward the base; terminal bud larger than the laterals, generally subtended by a pair of relatively large lateral buds, oval to ovate, $\frac{1}{4}$ — $\frac{1}{2}$ of an inch in length and over half as broad; bud scales usually 5 pairs, the innermost one or two pairs covered with dark, rusty-brown hairs. Mature bark nearly black, broken into firm, close, narrow ridges which anastomose and are separated by small, diamond-shaped areas.

Habitat—Grown as a park-, lawn-, and street-tree. Not exacting as to soil. Tolerant of unfavorable growing conditions about cities and fairly resistant to the attacks of insects and fungi.

Range—Native to western Europe and sparingly naturalized in the Northeast.

Uses—The chief value of this tree lies in its use as an ornamental and a number of varieties are recognized by arboriculturists. The wood is sometimes used in western Europe, but the tree is not grown for lumber in the United States.



Sugar Maple, Rock Maple

Acer saccharum Marsh. [*Acer saccharinum* Wagh., not L.;
Acer barbatum Michx.]

- | | |
|---|--|
| 1. A twig-tip showing staminate flowers $\times \frac{1}{2}$ | 4. A perfect flower, lateral view $\times 2$ |
| 2. A staminate flower, lateral view $\times 2$ | 5. A branch showing mature leaves and fruit $\times \frac{1}{4}$ |
| 3. A twig-tip showing pistillate flowers $\times \frac{1}{2}$ | 6. Winter twig $\times \frac{1}{2}$ |

ACERACEAE

Acer saccharum Marsh. [*Acer saccharinum* Wangh., not L.;
Acer barbatum Michx.]

Sugar Maple, Rock Maple

Habit—A valuable timber species usually 60—80 feet in height with a trunk diameter of 2—3 feet, under optimum conditions sometimes 135 feet tall with a trunk 5 feet through. In the open the bole divides 8—10 feet above the ground into stout, ascending branches which form a broad, ovoid, round-topped crown. Trees under forest conditions have a long, straight, columnar bole often free of branches for 60—70 feet and bearing a shallow, rounded crown with a few large limbs.

Leaves—Opposite, orbicular to broadly obovate, 3—5 inches across, cordate or rounded at the base, palmately 3—5-nerved and -lobed, the lobes acuminate, sparingly sinuate-toothed and separated by rounded sinuses. At maturity the leaves are rather thin, glabrous, dark green and dull above, paler and smooth below, and are borne on slender, glabrous petioles $1\frac{1}{2}$ —3 inches long.

Flowers—Appearing in April and May with the leaves, greenish yellow, polygamous, the staminate and pistillate flowers on the same or on different trees, borne on long, filamentous, hairy pedicels in drooping, many-flowered, nearly sessile, umbel-like corymbs from terminal leafy buds or lateral flower-buds. Calyx campanulate, hairy without, 5-lobed, the lobes shallow and obtuse. Corolla wanting. Stamens 7—8, exserted in the sterile flowers, with slender, glabrous filaments and oval anthers. Pistil consisting of a sessile, broadly obovate, laterally compressed, pale green, pilose ovary surmounted by 2 filamentous styles united at the base and bearing long, exserted stigmas.

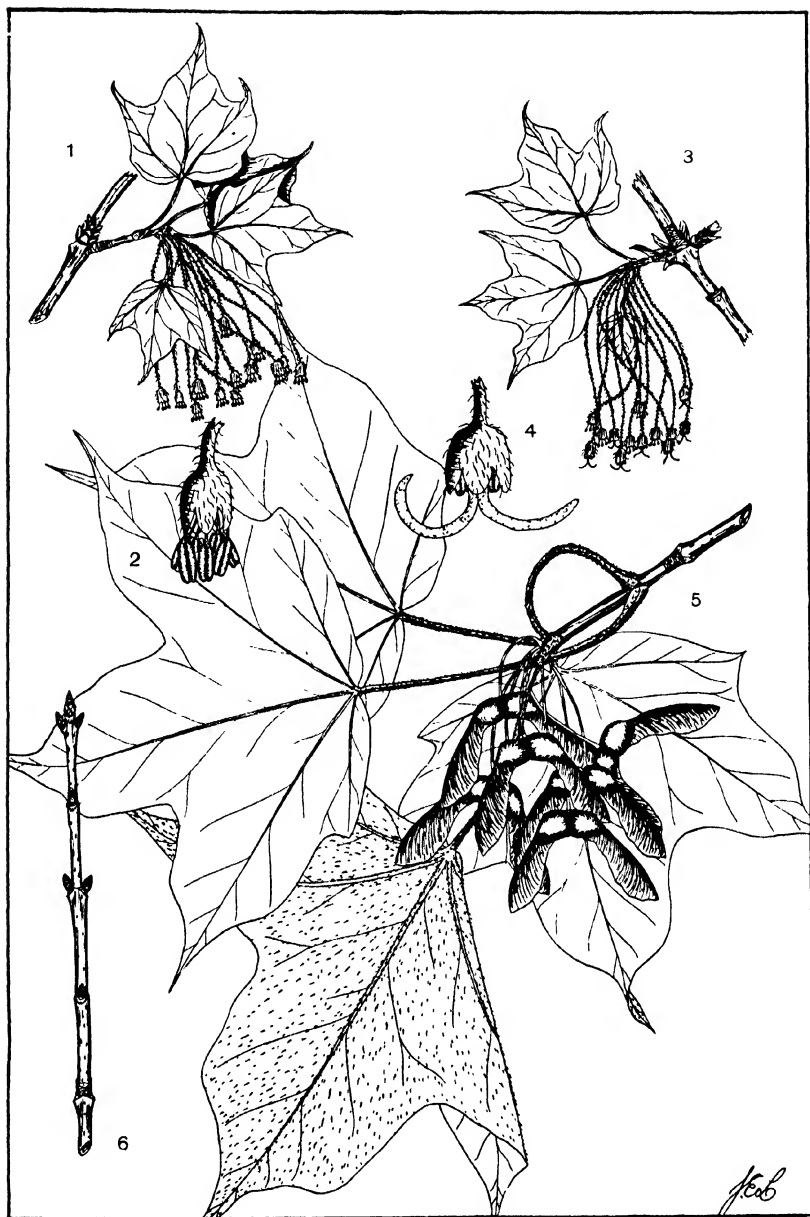
Fruit—A glabrous, double samara consisting of 2 light reddish brown, laterally compressed, 1-seeded carpels about $\frac{1}{4}$ of an inch long, equipped on the back with broad, thin, divergent wings $\frac{1}{2}$ — $1\frac{1}{4}$ inches long. The samaras are borne in clusters on long, smooth, filamentous stalks. Seed is produced every year, large crops coming at 3—5 year intervals.

Winter characters—Twigs slender, lustrous, reddish brown to buff, marked by numerous, conspicuous lenticels, becoming paler the second season. Terminal bud conical, reddish brown, hairy toward the apex, with 8—16 visible scales, about $\frac{1}{2}$ of an inch long. Lateral buds opposite, similar to the terminal bud but smaller. Mature bark thick, light grayish brown, separated by deep furrows into longitudinal ridges which are scaly at the surface, that of smaller trunks quite smooth.

Habitat—An upland species preferring the rich, well-drained, rocky soils of slopes, ridges and hills. Thrives on sites underlaid with limestone. In the hardwood forests of the Northeast, commonly associated with Beech and Yellow Birch, also with Red Spruce, White Pine, Hemlock and occasionally with Cherry; farther South it is mixed with the central hardwoods.

Range—Southern Newfoundland and Nova Scotia along the northern borders of the Great Lakes to Minnesota and northeastern South Dakota, south in the mountains to northern Georgia and through eastern Kansas and central Oklahoma to eastern Texas.

Uses—One of the most valuable timber trees of the forests of eastern United States and furnishing most of the 'hard maple' lumber of the trade. Wood hard, heavy, strong, close-grained, pale reddish brown with narrow, paler heartwood. Largely used for furniture, flooring, interior finish, turnery, etc., and for fuel in the rural districts. Bird's-eye and curly maple are especially prized in cabinet work. This tree is tapped in the spring and produces the maple syrup and sugar of the trade. It makes an excellent shade and ornamental tree and is commonly planted along country roads and on private estates. A number of varieties are recognized.



Black Maple

Acer nigrum Michx. f. [*Acer saccharum* var. *nigrum* (Michx. f.) Britt.;

Acer saccharinum var. *nigrum* (Michx. f.) Loud.]

1. Portion of a branch showing staminate flowers and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 2$
3. Portion of a branch showing pistillate flowers and immature leaves $\times \frac{1}{2}$
4. A pistillate flower, lateral view $\times 2$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

ACERACEAE

Acer nigrum Michx. f. [**Acer saccharum** var. **nigrum** (Michx. f.) Britt.;
Acer saccharinum var. **nigrum** (Michx. f.) Loud.]

Black Maple

Habit—Similar in habit to Sugar Maple and not distinguished in the trade. A valuable timber species, becoming under optimum conditions 80 feet in height with a trunk 3 feet in diameter. In the open the crown is ovoid, at length becoming broad and round-topped. Under forest conditions the bole is long and columnar, bearing aloft a shallow, flat-topped crown.

Leaves—Opposite, more or less drooping, orbicular to broadly obovate, 3—5 inches across, cordate at the base, palmately 3-veined and 3-lobed (rarely 5), the lobes acuminate, entire or somewhat undulate, and separated by broad, rounded sinuses. At maturity the leaves are rather thick, dull, dark green and glabrous above, yellow-green and velvety-pubescent below, and are borne on rather stout, pubescent petioles 2—5 inches long.

Flowers—Similar to those of Sugar Maple, but opening a few days later than the flowers of that species, when the leaves are about one-third grown.

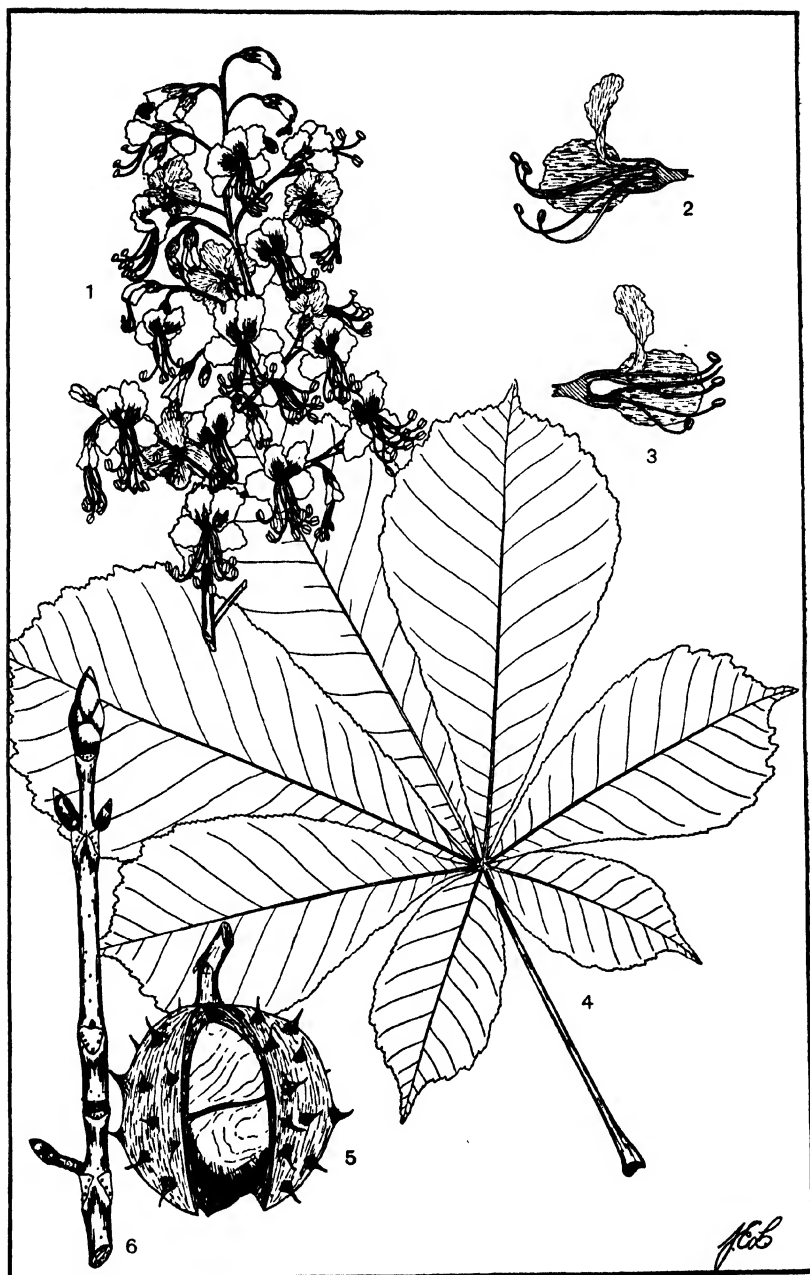
Fruit—Similar to that of Sugar Maple and not to be distinguished from it.

Winter characters—Twigs rather stout, lustrous or dull, orange-brown or grayish brown, marked by conspicuous, oblong, grayish white lenticels. Buds slightly larger than in Sugar Maple, likewise more pubescent. Terminal bud conical to ovate, grayish brown, hoary-pubescent, about $\frac{1}{4}$ of an inch long. Lateral buds opposite, similar to the terminal bud but smaller. Mature bark thick, deeply furrowed and sometimes nearly black, distinguishable from that of Sugar Maple in typical specimens. The common name of the tree is traceable to the dark bark.

Habitat—Black Maple is said to prefer lower ground than Sugar Maple. In the Northeast it grows on upland sites, intermixed with or in places wholly replacing Sugar Maple, with the same tree-associates.

Range—New England and Quebec through New York and southern Canada to northeastern South Dakota, south into western Pennsylvania, West Virginia, Kentucky, eastern Kansas and Missouri.

Uses—A valuable timber species. Readily distinguished from Sugar Maple by its thicker, 3-lobed, more or less drooping leaves which are velvety-tomentose below and possess pubescent petioles. Wood similar to that of Sugar Maple and not distinguished in the trade. The trees are tapped indiscriminately with those of Sugar Maple for their sugary sap.



Horse Chestnut

Aesculus hippocastanum L.

1. An inflorescence, lateral view $\times \frac{1}{4}$
2. A staminate flower, lateral sectional view $\times 1$
3. A perfect flower, lateral sectional view $\times 1$
4. A mature leaf $\times \frac{1}{2}$
5. Mature fruit, lateral view $\times \frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

SAPINDACEAE
Aesculus hippocastanum L.

Horse Chestnut

Habit—A large tree, under favorable conditions sometimes attaining a height of 70—80 feet with a trunk diameter of 2—3 feet. Trunk continuous into the crown or more frequently dividing 6—8 feet above the ground into a number of stout, ascending limbs and spreading branches which form an oblong or broadly conical crown. Lower branches drooping, with upturned tips.

Leaves—Opposite, palmately compound, 6—15 inches in diameter, consisting of 5—7 (usually 7) leaflets, borne on stout petioles which are swollen at the base and measure 4—7 inches in length. Leaflets wedge-obovate, 4—8 inches long, abruptly acuminate at the apex, tapering to a sessile base, irregularly crenate-dentate, rusty floccose-tomentose toward the base beneath when young, at maturity dark green, rugose, and nearly glabrous above, paler beneath.

Flowers—Appearing in June and July after the leaves, polygamous, in compact, terminal, upright thyrses 6—12 inches high, only those near the base of the inflorescence fertile. Calyx campanulate, finely pubescent, usually gibbous on the lower side near the base, 5-lobed. Petals 5, white spotted with yellow and purple, unequal in size, inserted by a claw at the base. Stamens 6—8, longer than the petals, with slender, upcurving filaments and small, elliptical anthers. Pistil consisting of an oblong, pubescent ovary surmounted by an elongated, slender, upcurving style and terminal stigma.

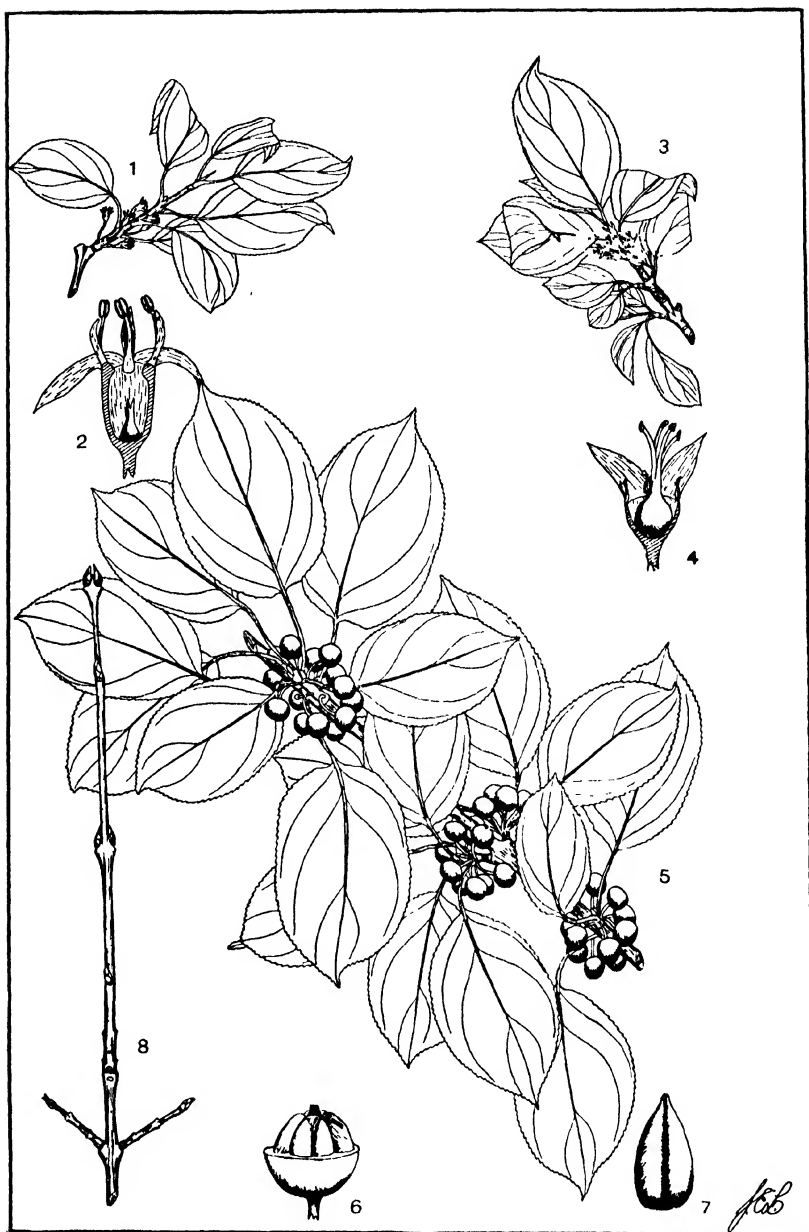
Fruit—A light green, coriaceous, echinulate, 3-celled capsule, 2—3 inches in diameter, turning brown in the autumn and opening by several sutures to set free the 1—3 large, lustrous, brown seeds, each marked by a conspicuous scar.

Winter characters—Twigs stout, reddish brown, glabrous or finely pubescent, marked by the large, inversely triangular leaf-scars which enclose a U-shaped line of 5—7 bundle-scars. Twigs fork after flowering, an axillary bud then functioning as a terminal bud. Buds large, reddish brown, water-proofed with a sticky gum. Terminal flower-buds $\frac{3}{4}$ —1 inch long, much larger than the lateral buds. Bud-scales opposite, paired, about 5 pairs visible in the largest buds. Mature bark thin, dull brown, shallowly fissured into small, irregular, plate-like scales.

Habitat—Prefers deep, moist soils. Extensively planted as a shade and ornamental tree in this country and found as an 'escape' along highways and about the habitations of man.

Range—Originally from the Balkan Peninsula but now much planted in America and Europe as a shade and ornamental tree.

Uses—Its chief value lies in its extensive use as a shade and ornamental tree. A number of horticultural varieties, including forms with lacinate leaflets and double flowers, are propagated. Wood light, soft, not strong, close-grained, pale yellowish white. Employed in Europe in carving, turnery and as blind-wood in veneering.



Common Buckthorn, Waythorn, Plumberry

Rhamnus cathartica L.

1. A twig showing staminate flowers and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral sectional view $\times 5$
3. A twig showing pistillate flowers and immature leaves $\times \frac{1}{2}$
4. A pistillate flower, lateral sectional view $\times 5$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Fruit, lateral view, showing nutlets $\times 2$
7. Nutlet, dorsal view $\times 3$
8. Winter twig $\times \frac{1}{2}$

RHAMNACEAE
***Rhamnus cathartica* L.**

Common Buckthorn, Waythorn, Plumberry

Habit—A large shrub, or a small tree occasionally 30 feet in height with a stout trunk 6—12 inches in diameter. Bole short, dividing 2—5 feet above the ground into a number of stout, ascending limbs which form an oblong or globular, bushy crown.

Leaves—Chiefly subopposite, more rarely alternate, tufted, broad-ovate to elliptic and oval, $1\frac{1}{2}$ —3 inches long, abruptly acute or obtuse at the apex, rounded or obtuse at the base, finely crenate-serrate, at maturity dark dull green and glabrous above, paler and usually glabrous beneath, borne on slender petioles $\frac{3}{4}$ —1 inch long.

Flowers—Appearing in May and June after the leaves in 2—5-flowered, axillary clusters, green, 4-merous, dioecious. Calyx-tube in staminate flower cylindrical, in pistillate flower campanulate. Calyx-lobes triangular, acute, ascending or somewhat reflexed. Petals narrow, shorter than the calyx-lobes, inserted with the stamens on the calyx-tube. Stamens shorter than the calyx-lobes, with awl-shaped filaments and oblong anthers. Pistil consisting of a globose, 4-celled ovary surmounted by 4 linear styles which are united below and bear terminal stigmas.

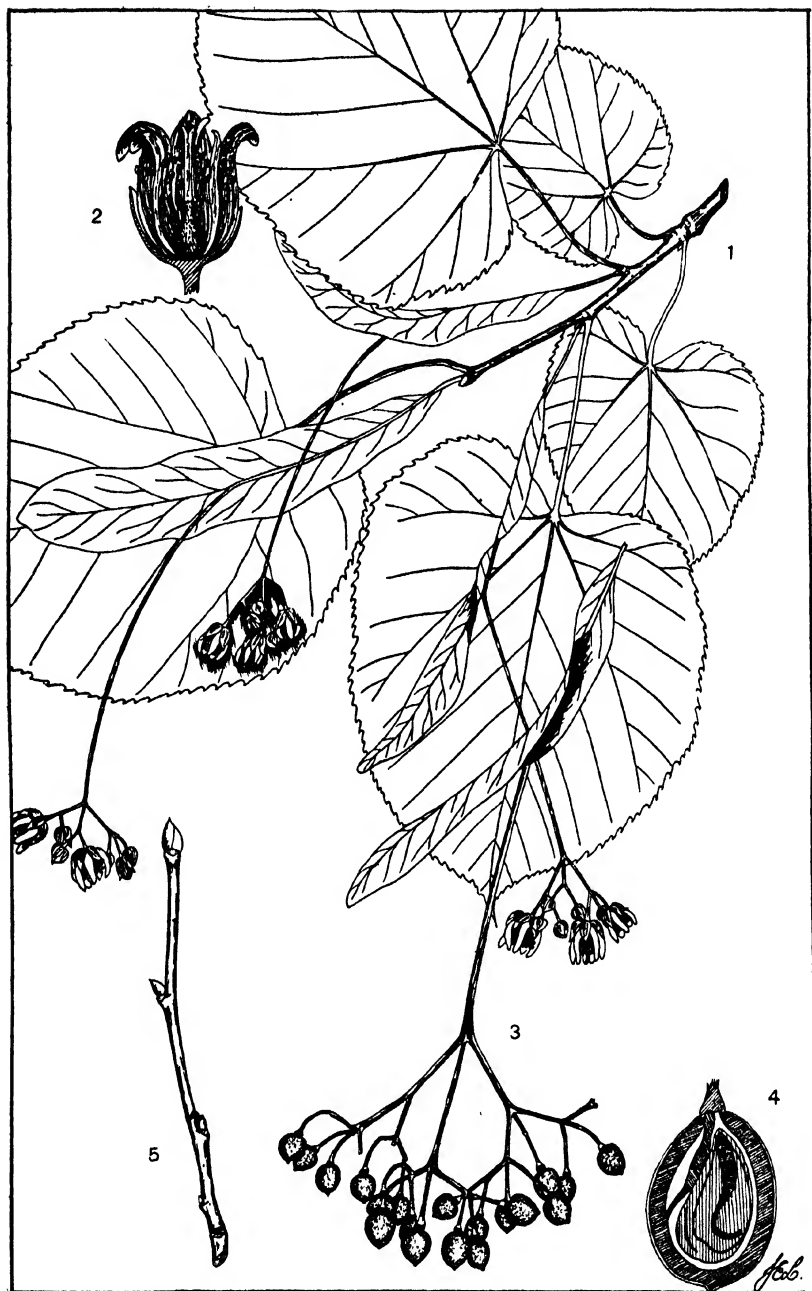
Fruit—A subglobose, lustrous, black drupe, about $\frac{1}{4}$ of an inch in diameter, containing thin, acrid flesh and 3—4 bony nutlets. Nutlets strongly sulcate on the outer face.

Winter character—Twigs rather slender, pale reddish brown with a grayish evanescent skin, at length brownish black. Shoots of two sorts, long shoots and short, often spinulose, dwarf shoots which bear flowers and tufted foliage during the summer. Buds ovate, acute, appressed, brownish black, about $\frac{1}{4}$ of an inch long. Mature bark thin, very rough, nearly black in color.

Habitat—In waste places along fence rows and highways, and in abandoned fields where it is widely spread through the agency of birds. Thrives on a variety of upland sites.

Range—Europe, and western and northern Asia. Introduced into this country as a hedge plant and now widely naturalized throughout the eastern United States.

Uses—Its economic status in this country rests on its use as a hedge plant for which it is well adapted because of its compact head of many small, spiny branches, and the ease of propagation. The bark yields a cathartic and a yellow dye. The close-grained wood is sometimes used for turnery and tool handles in the Old World.



Basswood, American Linden

Tilia glabra Vent. [*Tilia americana* L., in part]

1. A branch showing inflorescences and mature leaves $\times \frac{1}{2}$ 3. A fruit-cluster with leafy bract $\times \frac{1}{2}$
 2. A flower, lateral sectional view $\times 4$ 4. Fruit, lateral sectional view $\times 3$
 5. Winter twig $\times \frac{1}{2}$

TILIACEAE

Tilia glabra Vent. [*Tilia americana* L., in part]

Basswood, American Linden

Habit—A valuable timber tree, generally 70—80 feet in height with a trunk 2—3 feet in diameter, under favorable conditions sometimes 125 feet tall and 4 feet in diameter. Bole straight, continuous into the crown, bearing slender, lateral branches which form a dense, ovoid crown. In the open the lower branches are pendulous and reach within a few feet of the ground. Forest-grown specimens have straight columnar trunks and high crowns. Fairly tolerant. Fast growing. Sprouts vigorously from the stump.

Leaves—Alternate, broad-ovate, 5—6 inches long, abruptly acuminate at the apex, cordate or rarely truncate and inequilateral at the base, coarsely serrate with incurved, glandular teeth, at maturity thick, dark dull green and glabrous above, paler and glabrous below aside from tufts of rusty brown hairs in the axils of the prominent veins, borne on slender petioles $1\frac{1}{2}$ —2 inches in length.

Flowers—Appearing in early July after the leaves, perfect, fragrant, yellowish white, borne in drooping, cymose clusters on long peduncles which are united for about half their length with a conspicuous, pale green, ligulate bract. Sepals 5, lanceolate, pubescent, about $\frac{1}{4}$ of an inch long. Petals 5, lanceolate, longer than the sepals, with a spatulate staminode at the base. Stamens numerous, hypogynous, shorter than the petals, collected in 5 groups one of which is inserted at the base of each staminode. Pistil consisting of a sessile, pubescent, globose, 5-celled ovary crowned by an erect style bearing a 5-lobed stigma at the tip.

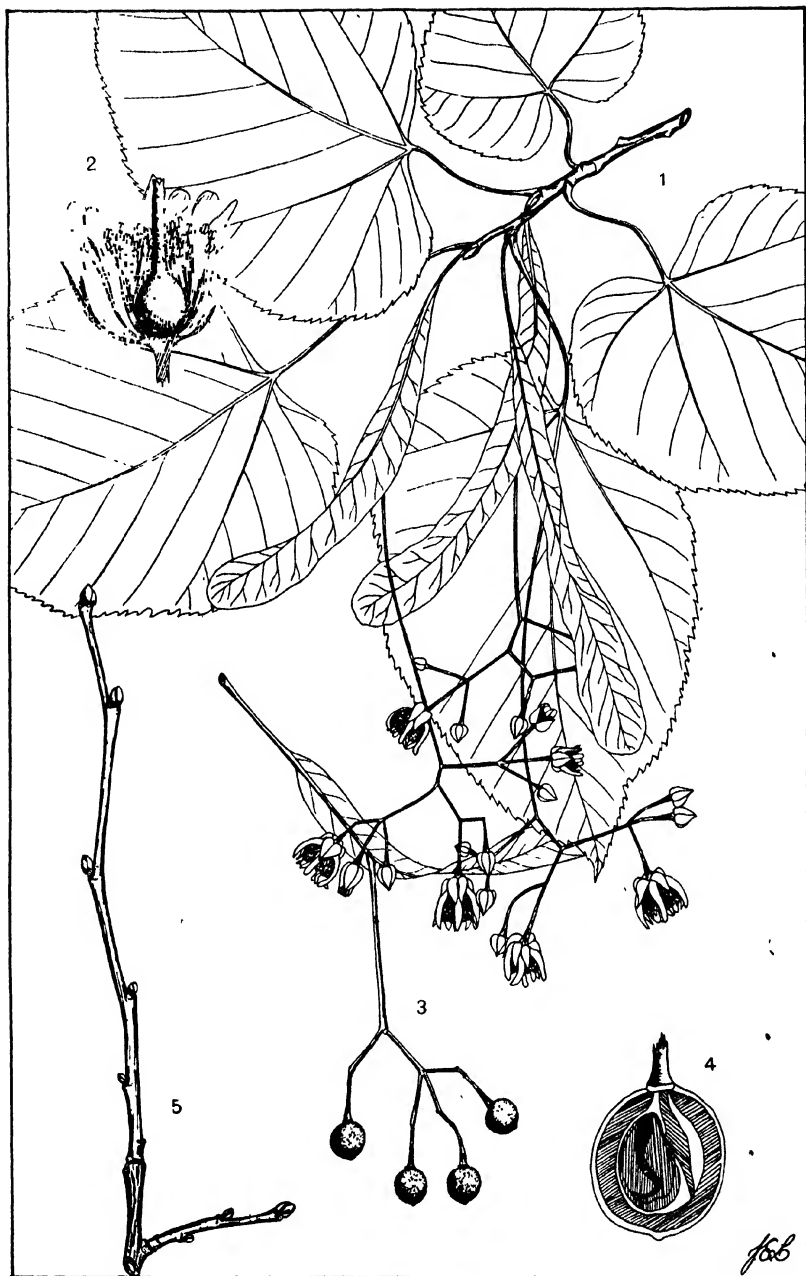
Fruit—A short-oblong to oblong-obovoid, tawny-brown, apiculate, pubescent, woody, nut-like drupe, about the size of a pea, borne in cymose clusters on a long stalk attached at the base to the persistent, leafy bract, usually persisting on the trees far into the winter. Ligulate fruiting bract usually tapering or stalked at the base. Drupe 1-celled and usually 1-seeded by abortion. Seed broadly ovoid, about $\frac{1}{2}$ of an inch long. Seed production is good but the seeds usually require more than one year for germination.

Winter characters—Twigs rather slender, zigzag, glabrous, lustrous, bright red, becoming olive-red or covered with a gray, evanescent skin the second season, marked with scattered, oblong lenticels. Terminal bud lacking. Lateral buds ovate, acute, lopsided, divergent, dark red or greenish red, smooth or somewhat pubescent at the apex, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. Visible bud-scales 2—3, thick, rounded at the back, inserted separately. Mature bark thick, light brown, divided by deep fissures into rounded, anastomosing ridges which are scaly at the surface. Bark on young stems dark gray and smooth.

Habitat—In rich woods and loamy soils, usually in admixture with other species. Thrives in moist, fertile, bottomland forests.

Range—New Brunswick westward through southern Canada to Manitoba (Lake Winnipeg), southward in the United States to Virginia, Alabama and eastern Texas.

Uses—A valuable timber species. Wood light, soft, moderately strong, fine-textured and even-grained, light brown to nearly white, with thick, scarcely distinguishable sapwood. Used extensively for crating, cheap furniture, woodenware, drawing boards, toys, trunks, etc., where a soft, tough, easily worked wood is desirable. Small quantities are manufactured into paper pulp and excelsior. The flowers are nectariferous and are eagerly sought by honey bees. The inner bark (bast) is fibrous, hence the name, Basswood, and is sometimes manufactured into cordage. The tree possesses some ornamental value but other species of *Tilia* are usually grown for this purpose. Several varieties and hybrids with European species are recognized.



White Basswood, White Linden

Tilia heterophylla Vent., var *michauxii* (Nutt.) Sarg.
[*Tilia michauxii* Nutt.]

- | | |
|--|---|
| 1. A branch showing inflorescences and mature leaves x $\frac{1}{2}$ | 3. A fruit-cluster with leafy bract x $\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 4 | 4. Fruit, lateral sectional view x 3 |
| | 5. Winter twig x $\frac{1}{2}$ |

TILIACEAE

Tilia heterophylla Vent., var ***michauxii*** (Nutt.) Sarg.
[***Tilia michauxii*** Nutt.]

White Basswood, White Linden

Habit—Generally somewhat smaller than the common Basswood. A tree usually 50—60 feet in height with a trunk diameter of 3—4 feet, under favorable conditions occasionally 80 feet tall with a trunk 4 feet through. Bole straight, continuous into the crown, under forest conditions long and columnar. Crown at first dense and narrowly pyramidal, at length becoming broad and rounded.

Leaves—Alternate, ovate to ovate-oblong, $3\frac{1}{2}$ —6 inches long, abruptly acute or acuminate at the apex, cordate or truncate and very oblique at the base, coarsely serrate with short, slightly incurved, glandular teeth, at maturity membranous, dark green and more or less lustrous above, with short white or grayish tomentum below, borne on slender petioles 2—3 inches in length.

Flowers—Appearing in July. Smaller than those of Basswood, ***Tilia glabra*** Vent., but otherwise similar.

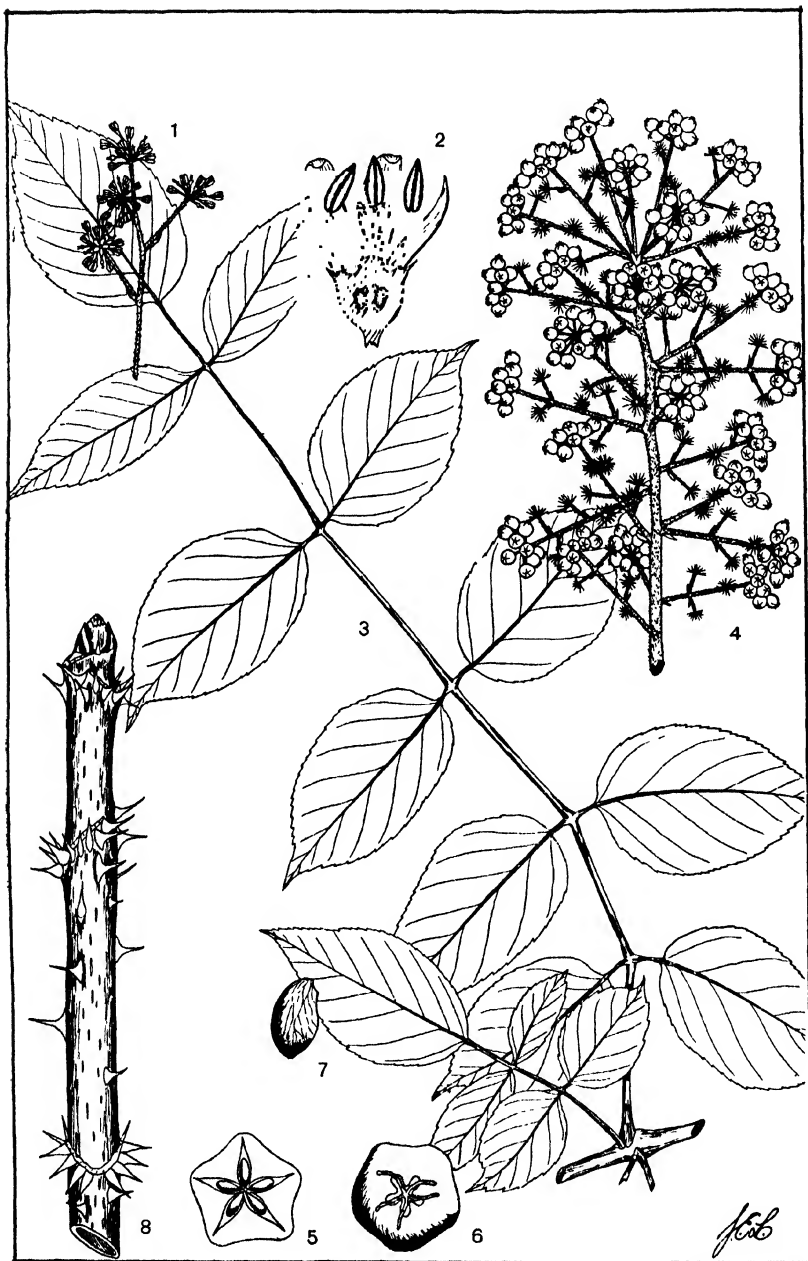
Fruit—Subglobose, rusty-tomentose, about $\frac{1}{2}$ of an inch in diameter (smaller than that of ***Tilia glabra*** Vent.), 1-celled and usually 1-seeded through abortion.

Winter characters—Twigs generally more slender than those of the common Basswood but otherwise similar. Buds also usually smaller than those of that species. Bark not distinguishable from that of other Basswoods.

Habitat—On limestone outcrops and in rich soils on moist slopes, growing in the open or in forests in admixture with other species.

Range—Central New York westward through southern Ohio, Indiana, and Illinois to northeastern Missouri, south to Georgia, central Alabama, northeastern Mississippi, and northwestern Arkansas.

Uses—The wood is not distinguished in the trade from that of the common Basswood. The tree is usually smaller than that species and hence is less valuable as a source of timber. Occasionally grown for ornament. Best distinguished from ***Tilia glabra*** Vent., by the whitish tomentum on the underside of the leaves.



Devil's Walking-stick, Hercules' Club

Aralia spinosa L.

1. A portion of the inflorescence x 1
2. A perfect flower, lateral sectional view x 10
3. A portion of a compound leaf showing leaflets x $\frac{1}{2}$
4. Terminal portion of a fruit-cluster x $\frac{1}{2}$
5. Fruit, apical sectional view x 3
6. Fruit, apical view x 5
7. Seed, lateral view x 5
8. Winter twig x $\frac{1}{2}$

ARALIACEAE
***Aralia spinosa* L.**

Devil's Walking-stick, Hercules' Club

Habit—A small tree of rapid growth, usually 20—35 feet in height with a trunk 6—9 inches in diameter, often a shrub sending up stout, vigorous shoots 10—20 feet in height from stoloniferous roots. Crown flat-topped, consisting of a few stout, spreading branches. Bole generally clean below.

Leaves—Alternate, clustered at the ends of the branches, odd-bipinately compound, 3—4 feet long, 2—2½ feet wide, borne on long, stout, spinulose petioles 18—20 inches long which are enlarged at the base and clasp the twigs. Pinnae usually with 5—6 pairs of leaflets, with a long-stalked terminal leaflet. Leaflets short-stalked, ovate, acuminate at the apex, cuneate or rounded at the base, finely serrate, at maturity thin, dark green and glabrous above, paler, glabrous or somewhat pubescent and often with prickles on the midribs beneath, 2—3 inches long.

Flowers—Appearing in late July and August, perfect or staminate by abortion, about $\frac{1}{8}$ of an inch long, borne on slender, straw-colored pedicels in panicked umbels the branches of which are pale brown, bracteolate and puberulous, the whole forming a terminal panicle cluster 3—4 feet long. Terminal clusters solitary or 2—3 together above the spreading leaves. Calyx-tube adherent to the ovary, the limb minutely 5-toothed. Petals 5, white, ovate, obtuse, inserted by a broad base on the margin of the disk. Stamens 5, alternate with and about equalling the petals, with slender filaments and ovate anthers. Pistil consisting of an inferior 5-celled ovary surmounted by 5 connivent styles crowned with capitate stigmas.

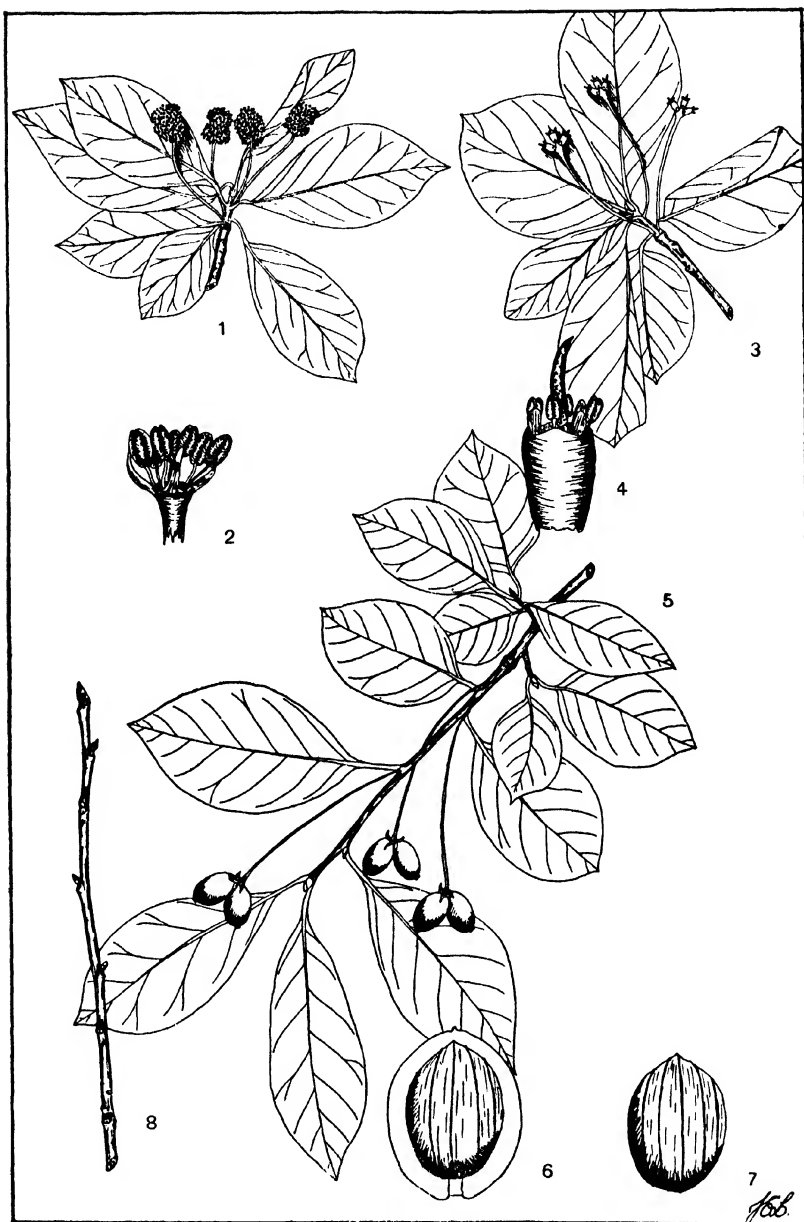
Fruit—An ovoid, 5-angled, black, berry-like drupe, about $\frac{1}{4}$ of an inch in diameter, capped by the blackened, persistent styles. The fruit ripens in late August and September. Seeds oblong, compressed, rounded at the ends, embedded in the thin, purple, very juicy flesh.

Winter characters—Twigs very coarse, $\frac{1}{2}$ —1 inch in diameter, pale orange, lustrous, lenticellate, characteristically armed with stout, irregularly scattered prickles. Leaf-scars narrow, nearly encircling the twig, with a single row of bundle-scars. Terminal bud conical, obtuse, chestnut-brown, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long. Lateral buds much smaller, flattened, appressed, triangular. Mature bark thin, brown, separated by shallow depressions into broad, anastomosing ridges. Inner bark yellow.

Habitat—Fertile bottomlands and moist or wet woodland slopes. Occasionally found as an 'escape' in dumps and waste places.

Range—Southern New York and Pennsylvania westward through southern Indiana and southeastern Iowa to southeastern Oklahoma, south to Florida and eastern Texas.

Uses—Of little economic importance aside from its ornamental value. It is a short-lived tree of rapid growth and grotesque habit, and is extensively planted for ornament in regions where it is hardy. The bark of the root and the berries possess some medicinal qualities.



Black Gum, Pepperidge, Tupelo

Nyssa sylvatica Marsh. [*Nyssa multiflora* Wagh.; *Nyssa aquatica* L., in part]

1. A twig showing staminate inflorescences and immature leaves $\times \frac{1}{2}$
2. A staminate flower, lateral view $\times 6$
3. A twig showing pistillate inflorescences and immature leaves $\times \frac{1}{2}$
4. A pistillate flower, lateral view $\times 6$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Drupe, lateral sectional view $\times 2$
7. Pit, lateral view $\times 2$
8. Winter twig $\times \frac{1}{5}$

NYSSACEAE

Nyssa sylvatica Marsh. [*Nyssa multiflora* Wanhg.; *Nyssa aquatica* L., in part]

Black Gum, Pepperidge, Tupelo

Habit—In the Northeast generally a medium-sized tree 40—70 feet in height with a trunk diameter of 1—3 feet, farther south occasionally 100—125 feet tall and up to 5 feet in diameter, at the northern limits of its range often reduced to a shrub. Trunk straight, continuous into the crown. Crown variable, sometimes short, cylindrical and flat-topped, at others pyramidal, conical, or inversely conical and flat-topped, composed of slender, tough, pendulous branches which extend to within a few feet of the ground. Short, stout spur-shoots numerous.

Leaves—Crowded at the ends of lateral branches or remote on vigorous shoots, alternate, obovate, obovate-elliptic, or elliptic, 2—5 inches long, acute at the apex, cuneate at the base, entire or rarely coarsely dentate, at maturity thick, dark green, and lustrous above, glaucous and smooth below or hairy on the veins, borne on ciliate petioles $\frac{1}{4}$ — $1\frac{1}{2}$ inches long. The leaves turn bright scarlet on the upper side before falling in the autumn.

Flowers—Appearing in May and early June when the leaves are about half grown, yellowish green, polygamo-dioecious, borne on long, slender, hairy peduncles. Staminate flowers in dense, many-flowered heads. Calyx tubular, minutely 5-lobed. Petals ligulate, acute, thick. Stamens 5—10, exserted in the sterile flower, sessile or wanting in the fertile flower. Fertile flowers in bracteolate clusters of 3. Calyx cylindrical, shallowly 5-lobed. Petals ovate, obtuse, blunt, much shorter than the calyx-tube. Pistil consisting of an inferior 1—2-celled ovary surmounted by a terete, pointed style stigmatic toward the tip.

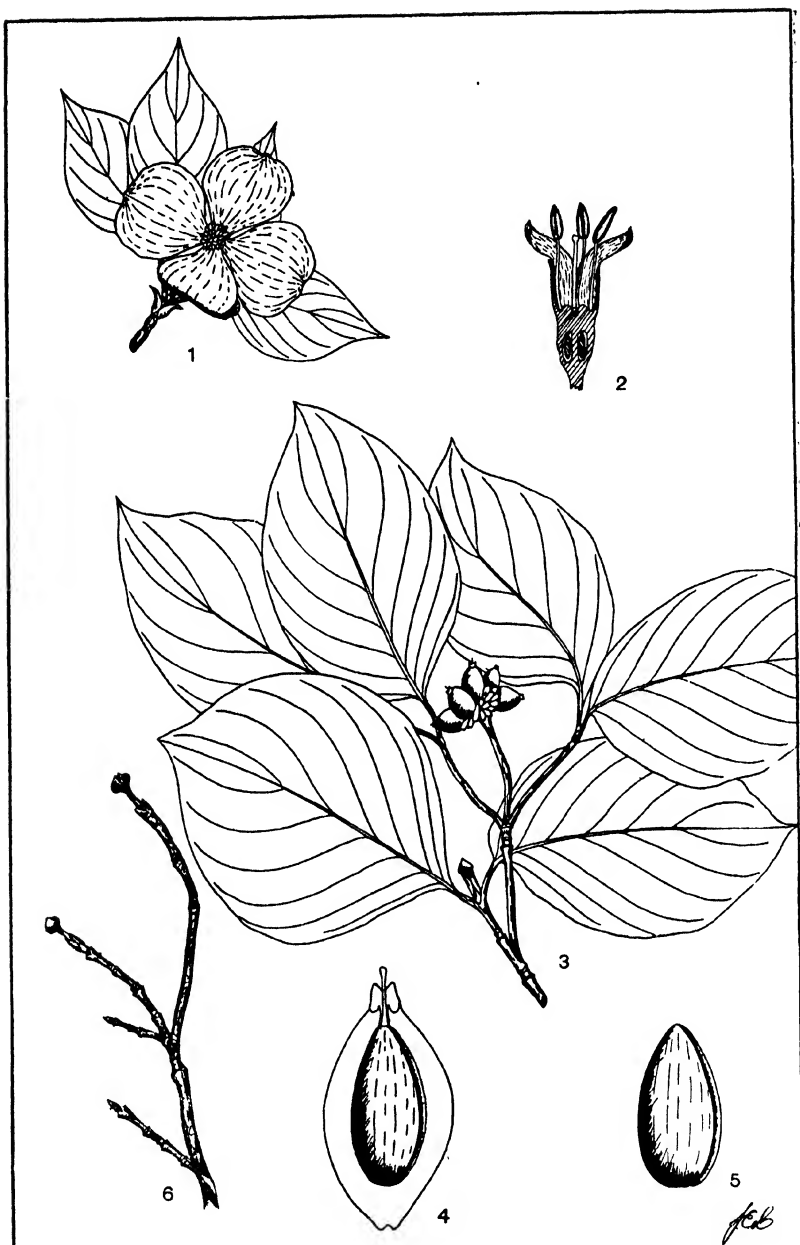
Fruit—An ovoid, dark blue drupe, from $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long, borne on long, slender peduncles in clusters of 1—3, ripening in October. Flesh thin, acid. Pit ovoid, slightly compressed, with 10—12 low, longitudinal ribs.

Winter characters—Twigs slender, smooth, grayish to reddish brown, with numerous lateral, short, slow-growing spurs crowded with leaf-scars. Pith diaphragmed-stuffed. Buds ovate, acute, smooth, reddish brown, about $\frac{1}{4}$ of an inch long, with 3—5 visible scales. Mature bark thick, grayish, divided by deep fissures and interrupted ridge into quadrangular or hexagonal blocks, resembling alligator-skin.

Habitat—This species is widely disseminated by birds and grows in a variety of habitats. It attains its best development along stream courses, and about the margins of ponds and sluggish streams, but thrives on hillsides and in abandoned pastures.

Range—Southern Maine westward through southern Ontario to southern Michigan and southern Missouri, south to northern Florida and eastern Texas. Spotty in its distribution in the Northeast.

Uses—A timber species of secondary importance. Wood medium heavy, moderately hard, strong, very tough, not durable, difficult to season, greenish or brownish gray with thick, paler sapwood. Largely used as 'thin' lumber in the manufacture of egg- and orange-crates. The toughness of the wood renders it valuable for wheel-hubs, rollers, etc. When treated, it is suitable for railroad ties.



Flowering Dogwood

Cornus florida L. [*Cynoxylon floridum* (L.) Raf.]

- | | |
|--|--------------------------------------|
| 1. A twig-tip showing terminal inflorescence x $\frac{1}{2}$ | 4. Drupe, lateral sectional view x 3 |
| 2. A flower, lateral sectional view x 3 | 5. Pit, lateral view x 3 |
| 3. A branch showing mature leaves and fruit x $\frac{1}{4}$ | 6. Winter Twig x $\frac{1}{2}$ |

CORNACEAE

Cornus florida L. [*Cynoxylon floridum* (L.) Raf.]

Flowering Dogwood

Habit—A low, bushy tree 15—30 feet in height with a trunk diameter of 6—10 inches, under optimum conditions occasionally 35—40 feet tall with a trunk 12—18 inches in diameter. Trunk short, with little taper, often oblique, abruptly breaking up 6—10 feet above the ground into a number of stout, elongated, wide-spreading limbs which form a broad, low, flat-topped crown.

Leaves—Opposite, clustered near the ends of the branches, ovate to elliptic and slightly obovate, with prominent arcuate veins, 3—6 inches long, acute at the apex, cuneate at the base, entire or remotely crenulate, at maturity thick, bright green with minute, appressed hairs above, paler or almost white and puberulous below. Petioles grooved, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—Appearing in May and June when the leaves are about half grown, sessile in the axils of small, deciduous bracteoles, the whole forming a dense, terminal head subtended by an involucre of 4 large, white or pinkish white, obovate, notched, petaloid bracts. Inflorescence 2—4 inches in diameter when fully expanded; individual flowers about $\frac{1}{8}$ of an inch across at anthesis. Calyx slightly urceolate, puberulous, somewhat 4-angled and 4-lobed at the top, adherent to the ovary. Petals 4, ligulate, reflexed after anthesis, inserted with the stamens at the top of the ovary. Stamens 4, exserted, with slender filaments and oblong anthers. Pistil consisting of an inferior, 2-celled ovary crowned with a slender filiform style and capitate stigma.

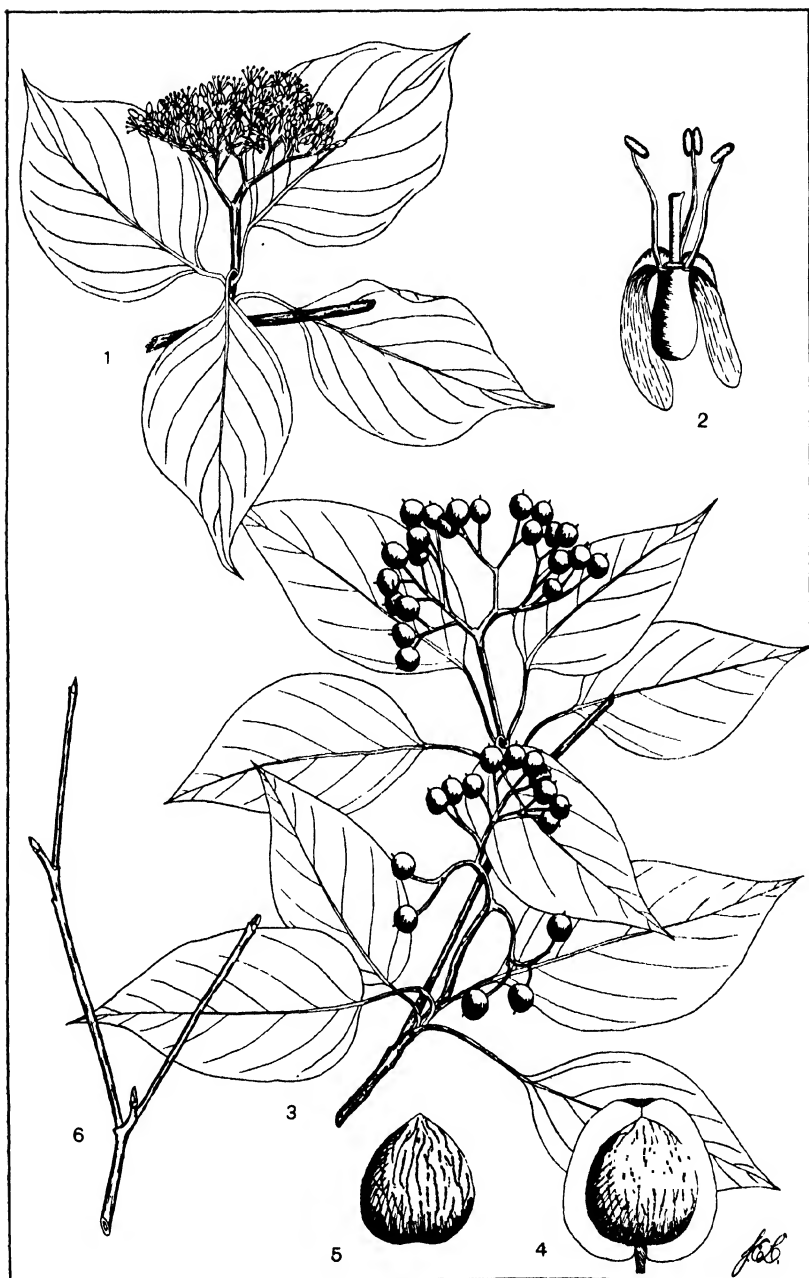
Fruit—A bright scarlet, lustrous, ellipsoid drupe, about $\frac{1}{2}$ of an inch long, crowned with the persistent calyx and withered style, borne in clusters of 3 or more and surrounded at the base by the remnants of abortive flowers. The drupes mature in September and October. Flesh thin, mealy. Pit ovate, grooved on one side, 2-celled, 1- or 2-seeded.

Winter characters—Twigs slender, red- or yellowish green, usually appearing somewhat mealy from minute, closely appressed pubescence. Leaf-scars decurrent, with V-shaped notch between, those on the older growth nearly encircling the twig. Terminal buds of two sorts. Terminal leaf-bud flattened, conical, covered by a single pair of bud-scales. Terminal flower-buds subglobose, covered by 4 scales which enlarge and turn white in the spring. Lateral buds minute, covered by the persistent bases of the leaf-stalks. Mature bark dark brown to black, broken into quadrangular scales, resembling alligator-leather.

Habitat—Attains its best development on rich, well-drained soils along streams and on moist slopes, generally in the shade of other species. Common in open woodland on rocky slopes and ridges.

Range—Southern Maine westward through southern Ontario and southern Michigan to southeastern Kansas, south to central Florida and in the West to Oklahoma, southwestern Arkansas, Texas, and northern Mexico. Spread through the agency of birds.

Uses—Wood hard, heavy, strong, close-grained, carneaous to light pinkish brown; heartwood, when present, dark brown, often streaked. Used for shuttles, bobbins, golf-club heads, mallets, tool handles, etc. Prized as an ornamental tree because of its unusual form, and showy flowers and fruits. Var. *rubra* West, with bright pink or red flowers, is extensively propagated. Var. *xanthocarpa* has yellow fruits and var. *pendula* is so named because of its pendulous branches.



Blue Dogwood, Alternate-leaved Dogwood

Cornus alternifolia L. [*Suida alternifolia* (L.) Small]

- | | |
|--|--|
| 1. Portion of a twig showing inflorescence and leaves $\times \frac{1}{2}$ | 3. A branch showing mature leaves and fruit $\times \frac{1}{2}$ |
| 2. A flower with two petals removed, lateral view $\times 4$ | 4. Drupe, lateral sectional view $\times 3$ |
| | 5. Pit, lateral view $\times 3$ |
| | 6. Winter twig $\times \frac{1}{2}$ |

CORNACEAE

Cornus alternifolia L. [*Suida alternifolia* (L.) Small]

Blue Dogwood, Alternate-leaved Dogwood

Habit—A small tree 20—30 feet in height with a trunk diameter of 6—8 inches or occasionally a foot through, commonly a tall shrub. Trunk short, beginning to divide 2—6 feet above the ground. Crown broad, deep, flat-topped, having a storied appearance owing to irregular whorls of branches which are borne on the stem in horizontal tiers at intervals.

Leaves—Alternate or subopposite, clustered near the branch-tips, elliptic-ovate to oval, 3—5 inches long, acuminate at the apex, cuneate or rounded at the base, obscurely crenulate, at maturity thin, yellowish green and glabrous or sparingly pubescent above, glaucescent and appressed-pubescent beneath, borne on slender, pubescent, grooved petioles $1\frac{1}{2}$ —2 inches long.

Flowers—Appearing in May and June after the leaves, borne on slender, jointed pedicels in flat, puberulous, many-flowered cymes $1\frac{1}{2}$ — $2\frac{1}{2}$ inches in diameter which are terminal on short, leafy, lateral branchlets. Individual flowers creamy-white, about $\frac{1}{4}$ of an inch long. Calyx oblong, pubescent, constricted above and obscurely toothed. Petals 4, oblong, obtuse, reflexed after anthesis, inserted with the stamens at the top of the ovary. Stamens 4, exserted, with slender filaments and oval anthers. Pistil consisting of an inferior, 2-celled ovary surmounted by a columnar style and terminal stigma.

Fruit—A bluish black, bloomy subglobose drupe, about $\frac{1}{3}$ of an inch in diameter, tipped by the remnant of the style, borne in loose, spreading, red-stemmed clusters, ripening in September and October. Flesh thin, bitter. Pit obovoid, pointed at the end, longitudinally many-grooved, thick-walled, 2-celled.

Winter characters—Twigs rather slender, elongated, glabrous and often lustrous, green or greenish brown, ill-scented and bitter to the taste when broken. Buds alternate or subopposite, oval, acute, chestnut-brown, with 2—3 visible scales. Mature bark thin, reddish brown, smooth or divided by shallow, vertical fissures into narrow, interrupted ridges.

Habitat—Rich, well-drained soils along the borders of forests, fence rows, and stream courses, usually in admixture with other species. Tolerant of shade.

Range—New Brunswick westward through southern Canada to Minnesota, south to Georgia and Alabama. Spread through the agency of birds.

Uses—Of no economic value aside from its use as an ornamental species. It is occasionally propagated in the eastern United States because of its unusual form, profusion of its blossoms and fruit, and the beauty of its autumnal coloration.



Mountain Laurel

Kalmia latifolia L.

- | | |
|--|-----------------------------------|
| 1. A flowering branch $\times \frac{1}{4}$ | 4. Fruit, lateral view $\times 2$ |
| 2. A flower, lateral sectional view $\times 1$ | 5. Seed $\times 10$ |
| 3. A branch showing mature leaves and fruit $\times \frac{1}{4}$ | |

ERICACEAE
Kalmia latifolia L.

Mountain Laurel

Habit—Generally a shrub 5—20 feet in height with a stem 1—6 inches in diameter, farther south at its optimum range occasionally 30—40 feet in height with a trunk 18—20 inches through. Trunk short, stout, often oblique, usually forking into a number of divergent branches which form a compact, round-topped crown.

Leaves—Alternate or occasionally opposite or in whorls of 3, persistent, elliptic to elliptic-lanceolate, 3—4 inches long, acute and sometimes with a callous point at the apex, cuneate at the base, entire, at maturity thick, coriaceous, dark green and rather dull above, yellowish green and paler below, borne on stout petioles about $\frac{3}{4}$ of an inch in length, falling during their second summer.

Flowers—Appearing in May and June from separate flower-buds formed the previous summer, showy, perfect, borne on red or green scurfy pedicels in terminal, compound, many-flowered corymbs about 4 inches in diameter. Calyx divided nearly to the base into 5 narrow, acute, green lobes which persist in fruit. Corolla white or rose-colored, rotate, with 10 pouches below the 5-parted limb; limb divided into 5 ovate, acute lobes. Stamens 10, hypogynous, shorter than the corolla, with filiform filaments and oblong anthers. Pistil consisting of a subglobose, glandular, 5-celled ovary surmounted by a filiform style and capitate stigma. Prior to anthesis the anthers are held in the corolla-pouches; at anthesis the 'bowed' filaments straighten elastically, raising the anthers aloft and catapulting the pollen from terminal pores.

Fruit—A globose, glandular-hispid, slightly 5-angled and 5-celled, woody capsule, about $\frac{1}{8}$ of an inch in diameter, crowned by the persistent style and subtended at the base by the persistent calyx, maturing in September and October. At maturity the capsule splits septicidally into 5 carpels which separate from the persistent central axis and open down the inner side by a narrow suture. Mature capsules persist on the plant until the following year. Seeds numerous, minute, oblong, winged.

Winter characters—Twigs reddish green and lustrous, becoming bright reddish brown the second year. Twig-tips often winter-killing. Leaf-buds ovate, small, acute, axillary. Flower-buds clustered above the leaf-bud, stouter, covered by numerous, glandular-pubescent scales. Mature bark thin, reddish brown, dissected by longitudinal fissures into narrow ridges which flake into long scales at the surface.

Habitat—At the northern limits of its range, mainly confined to low, rich bottomlands, farther south thriving on rich, rocky hillsides, often ascending to elevations of several thousand feet and covering extensive tracts in deciduous forests with a dense, almost impenetrable thicket.

Range—New Brunswick through southern New York to the northern shores of Lake Erie, south to Virginia, through Indiana to Tennessee, and in the mountains to western Florida and Louisiana.

Uses—One of the most attractive shrubs of the eastern United States, especially when it is covered with showy clusters of white or pink blossoms. A number of varieties are recognized. Easily raised from seed and readily transplanted. It will not thrive on limestone soils. The addition of leaf-mold as a top dressing to the soil is recommended. Hardy in shady or open situations within its range.



Great Rhododendron, Great Laurel

***Rhododendron maximum* L.**

- | | |
|---|---|
| 1. A flowering branch x $\frac{1}{2}$ | 4. Fruit, lateral view x $1\frac{1}{2}$ |
| 2. A flower, lateral sectional view x 2 | 5. Seed x 15 |
| 3. A branch showing mature leaves and fruit x $\frac{1}{2}$ | |

ERICACEAE
Rhododendron maximum L.

Great Rhododendron, Great Laurel

Habit—A shrub 5—12 feet tall, or southward in the mountains becoming a bushy tree 30—40 feet in height with a trunk 10—12 inches in diameter. Trunk generally short, crooked, ascending or often prostrate. Branches stout, contorted, forming a bushy, round-topped crown.

Leaves—Alternate, persistent, clustered near the branch-tips, ovate-lanceolate or obovate-lanceolate, 4—12 inches long, $1\frac{1}{2}$ — $2\frac{1}{8}$ inches wide, acute at the apex, cuneate or rounded at the base, entire and somewhat revolute on the margin, at maturity thick, coriaceous, dark green and lustrous above, pale-whitish below, borne on stout petioles 1 — $1\frac{1}{2}$ inches in length.

Flowers—Appearing in June and July from separate flower-buds formed the previous summer, showy, perfect, pale-rose to white in color,* borne on slender, glandular-pubescent, pink pedicels in 16—24-flowered, umbellate clusters 4—5 inches in diameter. Calyx light green, puberulous, persistent in fruit, with 5 oblong, rounded, rather remote lobes. Corolla campanulate, puberulent in the throat, gibbous posteriorly, cleft to the middle into oval, rounded lobes, the upper one yellow-spotted on the inner face. Stamens 8—12, of varying length, consisting of filaments which are flattened below and bearded with stiff white hairs, and white, oval anthers. Pistil consisting of an ovate, green, glandular-pubescent ovary terminated by an elongate, slender, declined style, and terminal, scarlet stigma.

Fruit—An oblong-ovoid, dark reddish brown, glandular-hispid capsule, about $\frac{1}{2}$ of an inch long, subtended at the base by the persistent calyx and crowned with the persistent style. In the autumn the capsule splits septically into 5 carpels which separate from the persistent central axis and open down the inner side. Seeds oblong, flattened, winged at the ends. The capsules persist on the twigs until the following season.

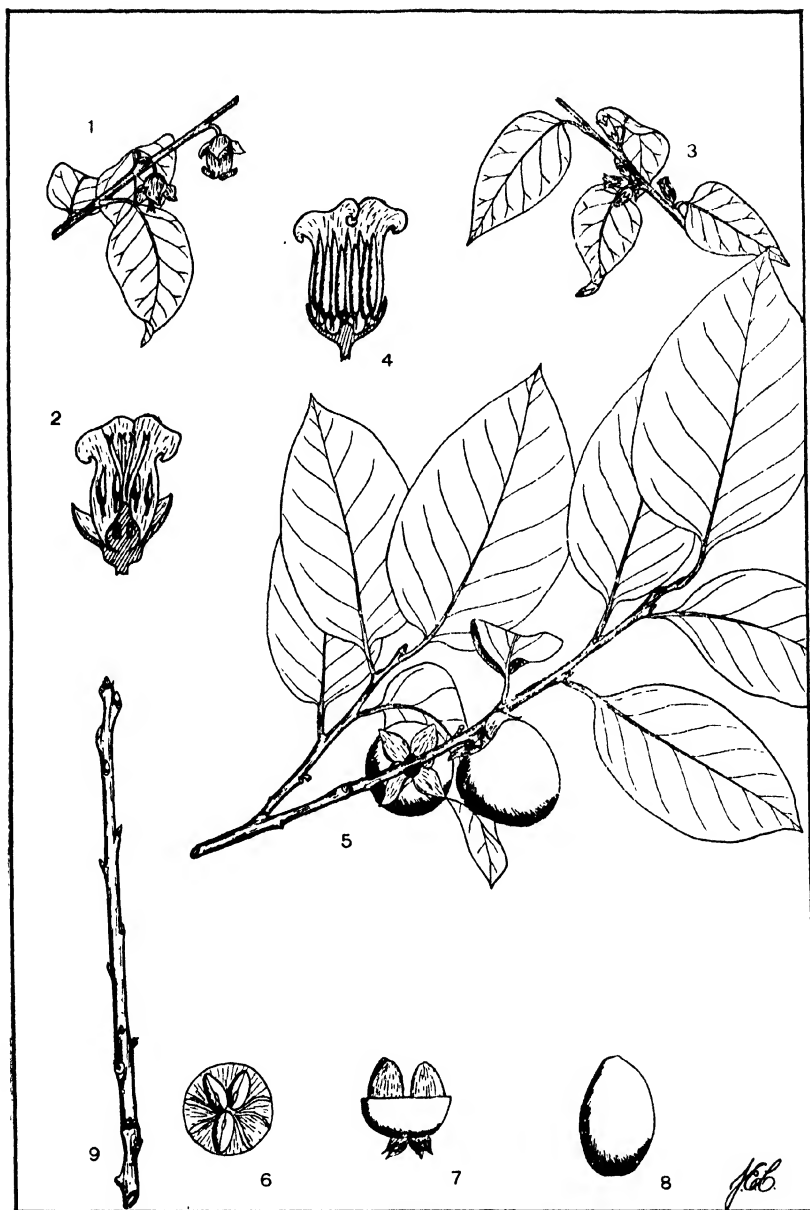
Winter characters—Twigs stout, dark green, glabrous, becoming bright reddish brown the second year. Leaf-buds conical, dark green, covered with many, closely imbricated scales. Flower-buds usually terminal, cone-shaped, 1 — $1\frac{1}{2}$ inches long, covered with many imbricated, ovate scales. Mature bark thin, reddish brown, peeling off at the surface into thin scales.

Habitat—At the northern limits of its range, confined to cold, springy swamps. Farther south it is found in moist, shady situations along the precipitous banks of mountain streams and in hilly woods at elevations up to 3000 feet.

Range—Nova Scotia to the northern shores of Lake Erie, southward into New England and New York and in the mountains to northern Georgia, westward into Ohio.

Uses—The Great Laurel is of distinct ornamental value because of its large, coriaceous, persistent leaves and showy flowers. It is often collected in carload lots directly from the woods and used extensively in moist, protected situations in park planting. Like the Mountain Laurel, it will not thrive on limestone soils. Wood heavy, hard, close-grained. Occasionally used in engraving as a substitute for boxwood, for tool handles, etc.

*Var *album* Pursh has white flowers, var. *purpureum* Pursh deep pink to purple flowers. Several hybrids are also recognized.



Persimmon

Diospyros virginiana L.

1. Portion of twig showing pistillate flowers and immature leaves $\times \frac{1}{2}$
2. A pistillate flower, lateral sectional view $\times 2$
3. Portion of twig showing staminate flowers and immature leaves $\times \frac{1}{2}$
4. A staminate flower, lateral sectional view $\times 2$
5. A branch showing mature leaves and fruit $\times \frac{1}{2}$
6. Fruit in cross section, apical view $\times \frac{1}{2}$
7. Fruit in cross section, lateral view $\times \frac{1}{2}$
8. Seed, lateral view $\times 1$
9. Winter twig $\times \frac{1}{2}$

EBENACEAE

Diospyros virginiana L.

Persimmon

Habit—Usually a small tree 40—50 feet in height with a trunk diameter of 6—12 inches, under optimum conditions occasionally 100 or even 130 feet tall with a trunk 2—2½ feet in diameter, frequently shrubby forming extensive thickets on abandoned lands and along hedge rows. Trunk slender, tapering, continuous into the crown, short or in forest grown specimens often free of branches for 50—70 feet. Crown cylindrical, with slender, spreading or drooping branches, becoming broad and round-topped with age.

Leaves—Alternate, ovate-oblong to oval and elliptic, 3—7 inches long, acuminate at the apex, broad-cuneate or rounded at the base, entire, at maturity thick, coriaceous, dark green and lustrous above, paler and usually glabrous beneath, borne on stout, glabrous or slightly villose-pubescent petioles ½—1 inch in length.

Flowers—Appearing in May and June on the shoots of the year when the leaves are partly grown, yellowish green, dioecious, the staminate in 2—3-flowered, pubescent, pedunculate cymes, the pistillate solitary and borne on short, recurved pedicels. Calyx deeply 4-lobed, the lobes ovate, acute, accrescent under the fruit. Corolla tubular or somewhat urceolate, with 4 short, reflexed lobes at the top. Stamens 16 in the staminate flower, inserted in 2 sets, with short filaments and sagittate anthers; stamens 8 in the fertile flower, generally abortive. Pistil consisting of a conical ovary which is pilose toward the top, surmounted by 4 slender styles bearing 2-lobed stigmas.

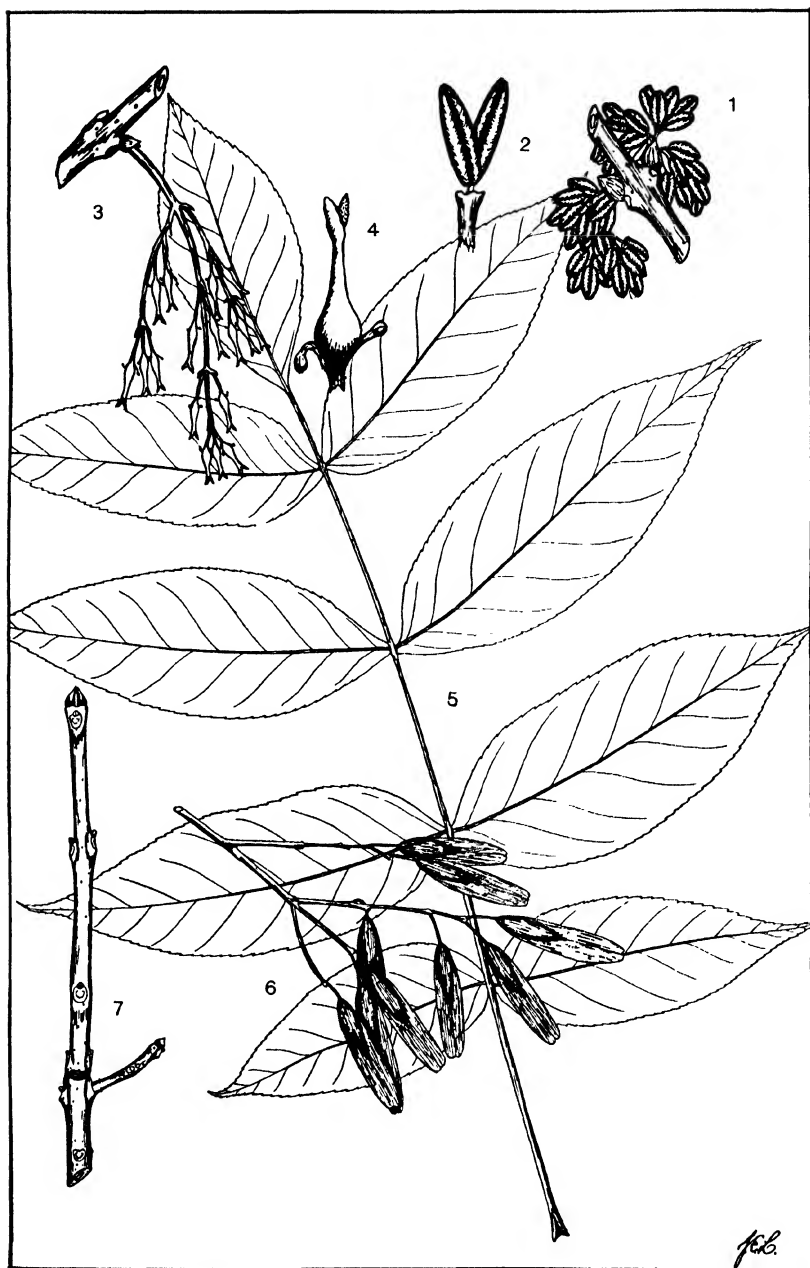
Fruit—A depressed-globose to ovoid or slightly obovoid, glaucous, pale orange-colored and often red-cheeked berry, 1—1½ inches in diameter, subtended by the four, accrescent calyx-lobes, borne on a short, thick, woody stalk. Seeds 1—8, oblong, rounded at the ends, compressed, embedded in the juicy, astringent flesh which becomes sweet and yellowish brown as the fruit ripens in the late fall. Fruits are produced abundantly every year and are very puckery before they are exposed to frost-action in the late autumn.

Winter characters—Twigs slender, astringent, pubescent or glabrous, orange-lenticellate, grayish or light brown becoming darker the second year. Terminal bud absent. Lateral buds ovate, acute, about ⅛ of an inch long, covered by 2 dark reddish brown or purplish scales. Mature bark resembling alligator-hide, thick, dark reddish brown to dark gray or nearly black, divided by deep fissures into small blocks which are scaly at the surface.

Habitat—Dry sandy soils in open woods, or on the deep moist soils of river bottoms, especially in the South. Mixed with other hardwoods.

Range—Connecticut (near New Haven) westward through southern Pennsylvania to southeastern Iowa and eastern Kansas, south to Florida and Texas.

Uses—Wood hard, heavy, fine-textured, yellowish white ageing to yellowish or grayish brown, with small, dark brown or nearly black heartwood. Used in the manufacture of shoe lasts, shuttles, sporting and athletic goods, etc. The fruit which is edible but very variable in its astringent qualities, is to be found in the markets of our southern cities in season.



Black Ash

Fraxinus nigra Marsh. [*Fraxinus sambucifolia* Lam.]

- | | |
|---|---|
| 1. Portion of twig showing staminate inflorescences x 1 | 4. A pistillate flower, lateral view x 5 |
| 2. A staminate flower, lateral view x 5 | 5. A mature leaf x $\frac{1}{2}$ |
| 3. Portion of twig showing pistillate inflorescence x 1 | 6. Portion of fruit-cluster x $\frac{1}{2}$ |
| | 7. Winter twig x $\frac{1}{2}$ |

OLEACEAE

Fraxinus nigra Marsh. [*Fraxinus sambucifolia* Lam.]

Black Ash

Habit—Generally a medium-sized tree 40–70 feet in height with a trunk diameter of 12–15 inches, under optimum conditions occasionally 80–90 feet tall and 20 inches through at the butt. Trunk tall, slender, bearing a high, narrow, shallow crown of numerous, ascending branches. In the open the tree is usually shorter with a round-topped crown which extends nearly to the ground. A typically northern species.

Leaves—Opposite, odd-pinnately compound, 10–16 inches long, borne on stout, pale petioles, consisting of 7–11 leaflets sessile except the terminal and arranged in pairs along the rachis. Leaflets oblong to oblong-lanceolate, 4–5 inches long, acuminate at the apex, unequally cuneate or rounded at the base, serrate, at maturity thin, firm, dark green and glabrous above, paler and glabrous below aside from tufts of rufous hairs along the midrib.

Flowers—Appearing in May before the leaves, polygamous, the staminate in dense, dark purplish clusters, the pistillate in elongate, rather open panicles. Perianth wanting. Stamens 2, with large, oblong, apiculate, dark purple anthers and short filaments. Pistil consisting of an ovate, glabrous ovary which gradually narrows above into a slender style bifurcated at the apex into broad, purple stigmas. Two stamens or staminodia are usually inserted below the pistil.

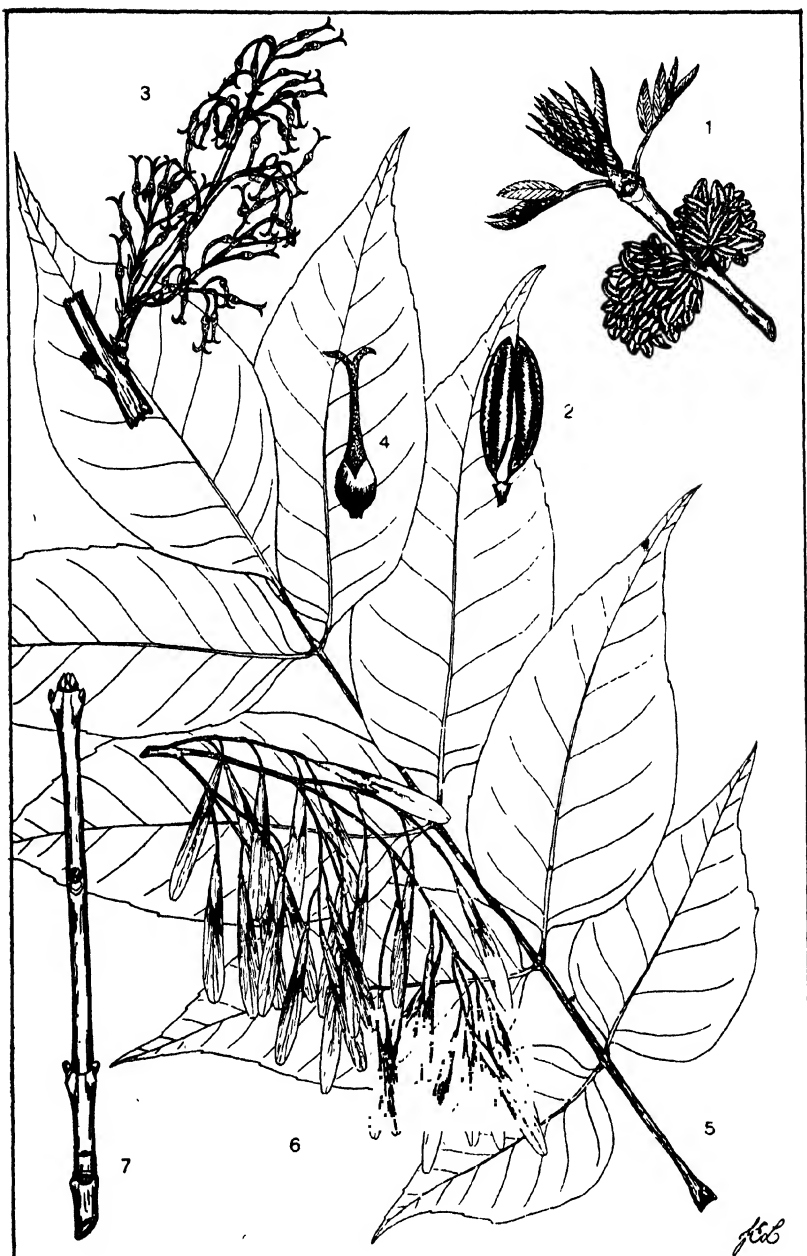
Fruit—An oblong or slightly oblong-obovate, light brown samara, 1–1½ inches long, consisting of a basal, somewhat flattened, seed-bearing portion terminated above by a notched or rounded wing which is decurrent to the base of the fruit. The samaras are borne in open panicles 8–10 inches in length, and mature in early autumn.

Winter characters—Twigs stout, glabrous, ashy-gray or pale-orange, marked by conspicuous, scattered lenticels and large, suborbicular leaf-scars. Terminal bud ovate, acute, black, ¼–⅜ of an inch long. Lateral buds broadly ovate, acute, dark brownish black and slightly puberulous, much smaller than the terminal bud. Visible bud-scales 1–2 pairs. Mature bark thin, ashy-gray to nearly black, divided by shallow anastomosing fissures into narrow, scaly and somewhat corky ridges.

Habitat—In low, wet woods on bottomlands or along sluggish rivers, at higher elevations along cold mountain streams and in deep, poorly-drained swamps. In the North associated with Tamarack, Northern White Cedar, Black Spruce, Red Maple and Yellow Birch, farther south with swamp hardwoods.

Range—Newfoundland to Manitoba (Lake Winnipeg), southward to Delaware, the mountains of Virginia and West Virginia, southern Indiana and Illinois, central Iowa, and Arkansas.

Uses—Wood moderately heavy, rather soft and weak, tough, coarse-grained, durable, grayish brown to brown with thin, paler sapwood. Frequently sold as Brown Ash in the trade. Because of its toughness the wood is used for hoops, chair bottoms, and pack baskets. Occasionally utilized instead of White Ash for interior finish in houses and for cabinet work. Black Ash is occasionally grown as an ornamental in swampy situations but is not to be recommended for this purpose.



White Ash

Fraxinus americana L.

1. A twig-tip showing staminate inflorescences and immature leaves $\times 1$
2. A staminate flower, lateral view $\times 5$
3. Portion of twig showing pistillate inflorescence $\times 1$
4. A pistillate flower, lateral view $\times 5$
5. A mature leaf $\times \frac{1}{2}$
6. Portion of fruit-cluster $\times \frac{1}{2}$
7. Winter twig $\times \frac{1}{2}$

OLEACEAE
***Fraxinus americana* L.**

White Ash*

Habit—A valuable timber species attaining a height of 70–80 feet with a trunk diameter of 2–3 feet, under favorable conditions sometimes 125 feet in height with a trunk 5–6 feet in diameter. In the forest the trunk is tall, straight, and massive, and bears a narrow, reduced, pyramidal crown. When growing in the open the crown is broadly pyramidal or oblong and round-topped, and often extends nearly to the ground. Quite intolerant of shade. Fast-growing in youth. Seeds at 3–5 yr. intervals.

Leaves—Opposite, odd-pinnately compound, 8–12 inches long, borne on stout, grooved petioles, consisting of 5–9 (usually 7) stalked leaflets arranged, except for the terminal, in pairs along the rachis. Leaflets ovate to oval and oblanceolate, often falcate, 3–5 inches long, attenuate at the apex, unequally cuneate or rounded at the base, entire or obscurely crenulate-serrate toward the apex, at maturity thin, firm, dark green and glabrous above, pale or light green, glabrous or pubescent and somewhat glaucous below.

Flowers—Appearing in May before the leaves, dioecious, the staminate in dense, purplish red clusters, the pistillate in rather open panicles. Calyx campanulate, inconspicuous and obscurely 4-lobed in the sterile flower, conspicuous and deeply 4-lobed in the fertile flower. Corolla lacking. Stamens 2 (occasionally 3), with large oblong-ovate, apiculate anthers and short filaments. Pistil consisting of an ovate ovary contracted above into an attenuate style bifurcated into stigmatic lobes.

Fruit—A lanceolate or oblanceolate, light brown samara, 1–2½ inches long, about ¼ of an inch wide, consisting of a basal, terete, seed-bearing portion prolonged above into a wing which is pointed or emarginate at the apex and terminal or slightly decurrent on the seed-bearing base. The samaras are borne in dense, drooping panicles 5–7 inches long which generally persist into the winter.

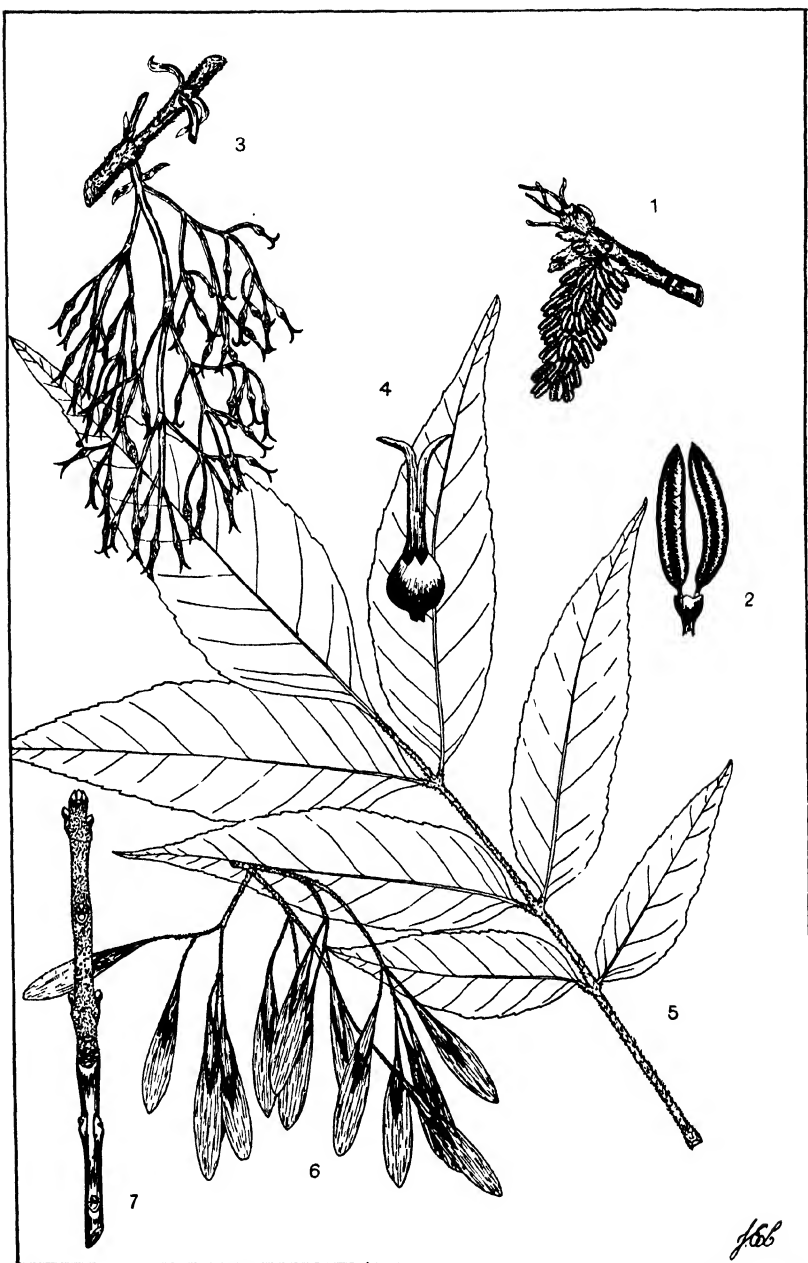
Winter characters—Twigs opposite, stout, flattened at the nodes, glabrous, lustrous or covered with a slight bloom, grayish brown, marked with scattered pale lenticels and prominent, semi-orbicular leaf-scars. Terminal bud hemi-spherical or broadly ovate and obtuse, rusty-brown to brownish black, scurfy or slightly downy, about ¼ of an inch long. Visible scales 2–3 pairs. Lateral buds smaller, with blunter bud-scales. Superposed buds present on vigorous shoots. Mature bark rather thick, grayish brown, divided by deep narrow fissures into anastomosing ridges which are flattened, transversely checked, and scaly at the surface.

Habitat—Attains its best development on rich, moist, well-drained bottomlands in admixture with other Hardwoods. Common in rolling country in fields, pastures, and along fence rows and stream courses.

Range—Nova Scotia and New Brunswick westward through southern Canada to eastern Minnesota and eastern Nebraska, south to Florida and eastern Texas. Best development is attained in the lower Ohio Valley.

Uses—A valuable timber species. Wood hard, medium heavy, strong, tough, elastic, somewhat lustrous, grayish brown, brown or pale yellow streaked with brown, with wide, pale sapwood. Extensively used in the manufacture of hoe-, rake-, and shovel-handles, baseball bats, agricultural implements and automobile-bodies, furniture, refrigerators, woodenware, novelties, etc. White Ash is of rapid growth and relatively immune from fungal diseases, and is to be recommended for reforestation in admixture with other species. Often planted as a shade and ornamental tree, and hardy under adverse conditions. A number of varieties are recognized.

*White Ash is frequently confused with Green Ash (see page 383). The latter has narrower leaflets with more pronounced serrations which extend farther toward the base, the leaflets are greener beneath, the terminal bud is more pointed, and the leaf-scar is notched.



Red Ash

Fraxinus pennsylvanica Marsh. [*Fraxinus pubescens* Lam.]

1. A twig-tip showing staminate inflorescence and unfolding leaf-buds x 1
2. A staminate flower, lateral view x 5
3. Portion of twig showing pistillate inflorescence x 1
4. A pistillate flower, lateral view x 5
5. A mature leaf x $\frac{1}{2}$
6. Portion of fruit-cluster x $\frac{1}{2}$
7. Winter twig x $\frac{1}{2}$

OLEACEAE

Fraxinus pennsylvanica Marsh. [*Fraxinus pubescens* Lam.]

Red Ash

Habit—A small or medium-sized tree generally 30—60 feet in height with a trunk diameter of 6—18 inches, under favorable conditions occasionally 65 feet in height and 2 feet in diameter. Bole similar to that of White Ash but usually shorter and more slender, and sometimes buttressed at the base. Crown compact, irregular, consisting of numerous, upright branches. This species never attains the size of White Ash.

Leaves—Opposite, odd-pinnately compound, 10—12 inches long, borne on stout, pubescent, slightly grooved petioles, consisting of 5—9 stalked leaflets arranged, except for the terminal, in pairs along the pubescent rachis. Leaflets oblong-lanceolate to ovate, 4—6 inches long, attenuate at the apex, unequally broad-cuneate at the base, obscurely serrate or entire, at maturity thin, firm, light yellow-green and glabrous above, pale silky-pubescent below.

Flowers—Appearing in May before or with the leaves, dioecious, the staminate in dense, purplish red clusters, the pistillate in open, greenish red panicles. Calyx cup-shaped, minute, obscurely toothed in the staminate flower, urceolate, more prominently lobed, and closely appressed to the ovary in the pistillate flower. Corolla lacking. Stamens 2, with linear-oblong, apiculate anthers and short filaments. Pistil consisting of an ovate ovary prolonged above into an elongated style bifurcated at the apex into green stigmatic lobes.

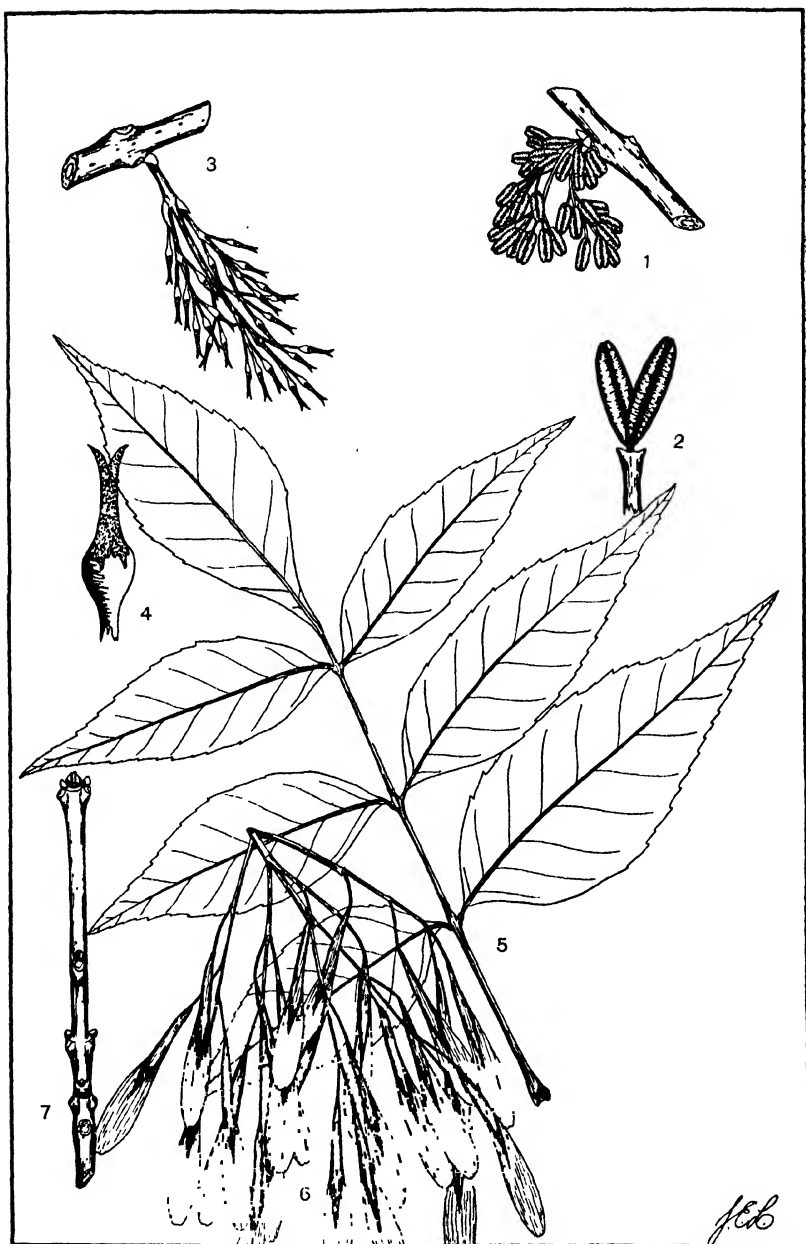
Fruit—A lanceolate or elliptic to slightly oblanceolate or oblong-obovate, light brown samara, 1—2½ inches long, ¼—½ of an inch wide, consisting of a slender, basal, terete, seed-bearing portion prolonged above into a thin wing which is rounded, acute, or occasionally emarginate at the apex and decurrent below the middle on the seed-bearing base. Wing as long or longer than the body. Samaras borne in open, pubescent panicles which persist into the winter.

Winter characters—Twigs opposite, rather slender, flattened at the nodes, ashy-gray or pale reddish brown, generally densely velvety-pubescent and marked with conspicuous semi-circular leaf-scars. Terminal bud ovate, acute, rusty-brown and tomentose, smaller than that of White Ash. Lateral buds smaller, with rounded bud-scales. Visible scales 2 pairs. Mature bark thin, grayish brown, similar to that of White Ash but more shallowly furrowed.

Habitat—Wet sites along sluggish rivers and lakes, often on lands inundated for a portion of each year, occasionally at higher elevations along stream courses. Occurs in mixture with other swamp hardwoods.

Range—Nova Scotia westward to Manitoba, South Dakota, eastern Nebraska, and northeastern and eastern Kansas, south to central Georgia.

Uses—Wood hard, medium heavy, medium strong, brash, light brown with thick, paler sapwood. Inferior to that of White Ash but used for the same purpose and often confused with it in the trade. Occasionally planted for ornament but inferior to White Ash except on moist sites. Two varieties are recognized including the form described on the next page with which Red Ash intergrades.



Green Ash

Fraxinus pennsylvanica var. *lanceolata* (Borkh.) Sarg. [*Fraxinus lanceolata* Borkh.; *Fraxinus viridis* Michx. f.]

- | | |
|---|---|
| 1. Portion of twig showing staminate inflorescence x 1 | 4. A pistillate flower, lateral view x 5 |
| 2. A staminate flower, lateral view x 5 | 5. A mature leaf x $\frac{1}{2}$ |
| 3. Portion of twig showing pistillate inflorescence x 1 | 6. Portion of fruit-cluster x $\frac{1}{2}$ |
| | 7. Winter twig x $\frac{1}{2}$ |

OLEACEAE

Fraxinus pennsylvanica var. *lanceolata* (Borkh.) Sarg. [*Fraxinus lanceolata* Borkh.; *Fraxinus viridis* Michx. f.]

Green Ash

Habit—Similar to Red Ash but usually a larger tree. Up to 70 feet in height with a trunk diameter of 2—3 feet. In the open the crown is broad and round-topped, and extends to within 6—8 feet of the ground. Trees in bottomland forests have slender boles and high, reduced crowns. This species is especially resistant to extremes of temperature and moisture.

Leaves—Opposite, odd-pinnately compound, 8—12 inches long, borne on stout, glabrous petioles, consisting of 5—9 stalked leaflets arranged, except for the terminal, in pairs along the smooth rachis. Leaflets lanceolate or ovate-lanceolate, 4—6 inches long, attenuate at the apex, cuneate at the base, sharply and irregularly serrate, at maturity thin, bright green, and somewhat lustrous on both sides, glabrous above, smooth or pubescent on the midrib below.

Flowers—Appearing in May before or with the leaves, dioecious, the staminate in purplish red clusters which are usually less dense than those of Red Ash, the pistillate in open, greenish red panicles. Calyx cup-shaped, obscurely toothed in the staminate flower, cup-shaped with jagged, more prominent lobes in the pistillate flower. Corolla lacking. Stamens 2, with linear-oblong, emarginate anthers and short filaments. Pistil consisting of an ovate ovary prolonged above into an elongated style bearing 2 stigmatic lobes at the apex.

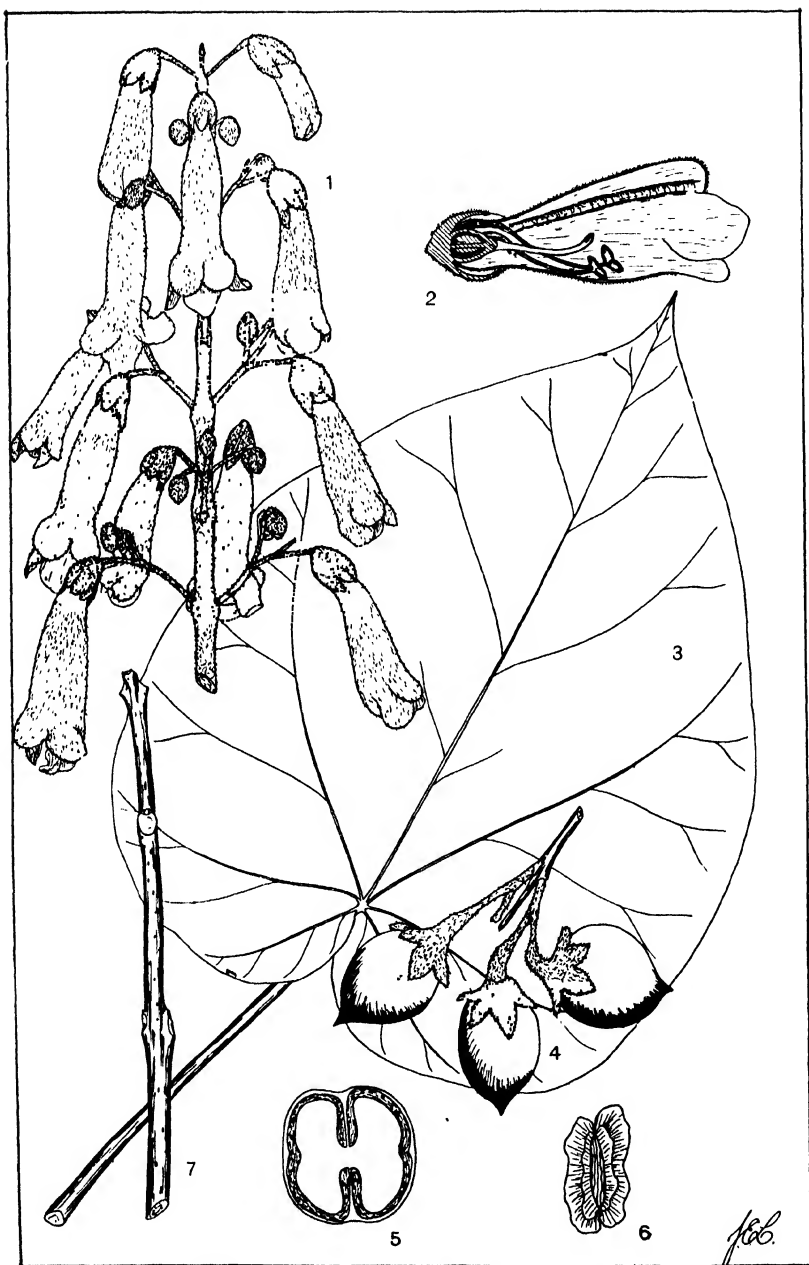
Fruit—Similar to that of Red Ash. A lanceolate or elliptic to slightly oblanceolate or oblong-obovate, light brown samara, 1—2½ inches long, with a slender, terete, seed-bearing portion and terminal, decurrent wing. Fruiting panicles open, glabrous, persisting into the winter.

Winter characters—Twigs opposite, rather slender, spreading, flattened at the nodes, glabrous, ashy-gray, marked by scattered lenticels and semi-circular leaf-scars. Terminal bud ovate, acute, flattened, rusty-tomentose, larger than the lateral buds. Visible scales 2 pairs. Mature bark thin, ashy-gray, with narrow fissures and narrow, anastomosing ridges.

Habitat—Similar to that of Red Ash but thriving on drier sites. Prefers damp situations along stream courses, lake shores and bottomlands. Especially typical along streams in the Prairie States.

Range—Maine westward through southern Canada to Saskatchewan, Montana, and Utah, southward in the mountains to western Florida, in the mountains of eastern and northern Arizona, and through Texas. The most widely distributed of the Ashes. Rare in the eastern portion of its range.

Uses—Wood hard, medium heavy, strong, light brown with thick, paler sapwood. Used for the same purposes as that of White Ash and not distinguished in the trade. This species is extensively used as an ornamental through the Central States. Distinguishable from Red Ash (p.—) by its narrower leaflets which are sharply serrate and glabrous below or pubescent only on the midrib, and by its smooth ultimate-twigs. Forms intermediate between Red Ash and Green Ash are frequently found. Grown for windbreaks on the Plains.



Paulownia

Paulownia tomentosa (Thunb.) Steud. [*Bignonia tomentosa* Thunb.;
Paulownia imperialis Sieb. et Zucc.]

1. A portion of an inflorescence $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times 1$
3. A mature leaf $\times \frac{1}{2}$
4. Cluster of capsules $\times \frac{1}{2}$
5. Capsule, cross section, showing
 placentae and seeds $\times \frac{3}{4}$
6. Winged seed, lateral view $\times 5$
7. Winter twig $\times \frac{1}{2}$

SCROPHULARIACEAE

Paulownia tomentosa (Thunb.) Steud. [*Bignonia tomentosa* Thunb.;
Paulownia imperialis Sieb. et Zucc.]

Paulownia

Habit—A low, wide-spreading tree 30—60 feet in height with a trunk 1—2 feet in diameter. Bole short, dividing 5—8 feet above the ground into a few stout, spreading limbs which form a broad, rounded or flat-topped crown.

Leaves—Opposite, broad-ovate to ovate, 5—8 inches long or on vigorous shoots much larger, acuminate at the apex, cordate at the base, entire or sometimes shallowly 3-lobed, at maturity thick, dark green and nearly smooth above, paler and densely pubescent or tomentose beneath, borne on stout, terete petioles 3—8 inches in length.

Flowers—Appearing in May before the leaves unfold, perfect, showy, fragrant, $1\frac{1}{2}$ —2 inches long, borne on stout, pubescent pedicels in terminal, upright panicles 8—12 inches long. Calyx rusty-tomentose, broad-campanulate, deeply 5-cleft, persistent in fruit, the lobes short and acute. Corolla pale violet with darker spots and yellow stripes within, funnelform-campanulate, glandular, pubescent without, irregular, the tube enlarged above and divided into 5 spreading, rounded, somewhat unequal lobes. Stamens 4, inserted on the corolla-tube, included, didynamous, with slender filaments and wide-spreading anthers. Pistil consisting of an ovate, 2-celled ovary surmounted by a filiform style somewhat thickened at the apex and stigmatic on the inner side.

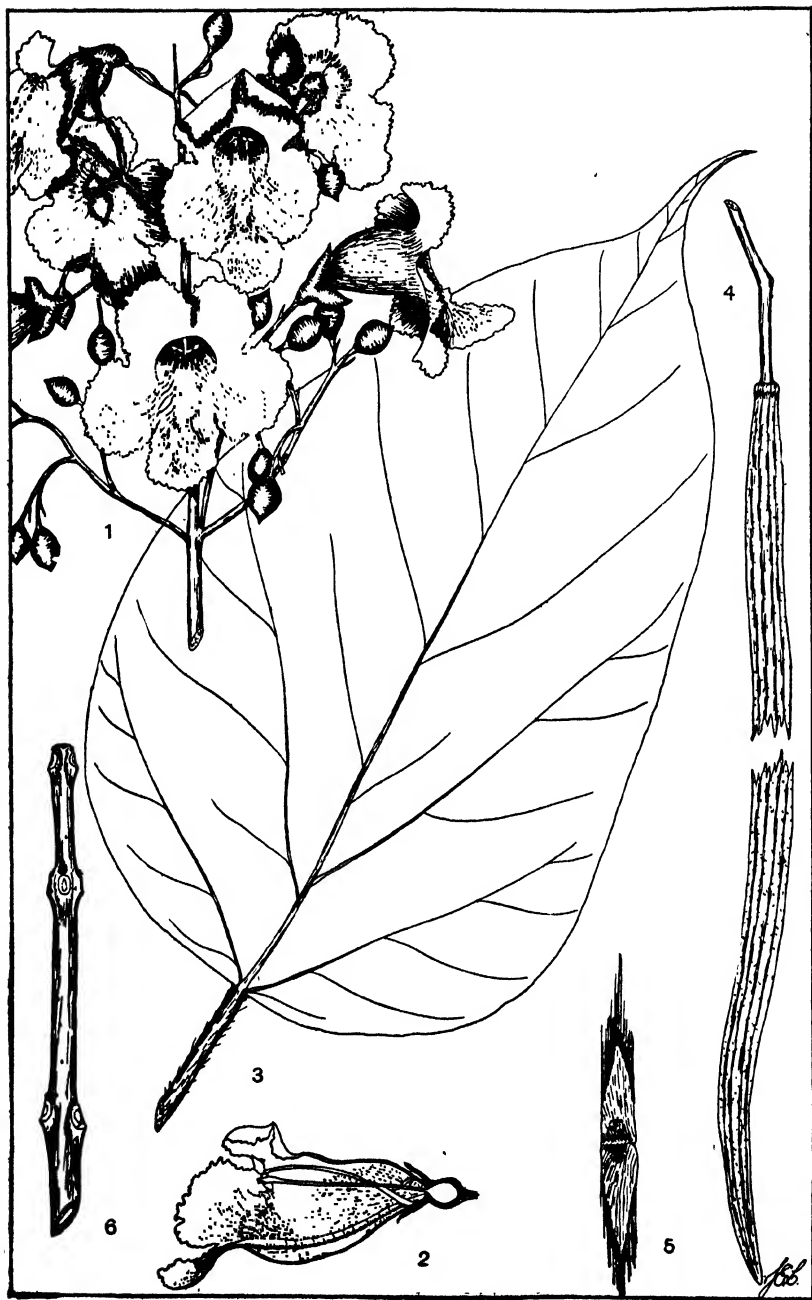
Fruit—A leathery, olive-brown or bronze, broadly ovoid, beaked capsule, 1—2 inches long, $\frac{3}{4}$ —1 inch thick, shallowly longitudinally grooved on either side, subtended by the persistent calyx. At maturity the capsule opens by 2 loculicidal sutures to set free the numerous, small, lace-winged seeds. The opened capsules persist on the branches throughout the winter.

Winter characters—Twigs stout, glabrous, greenish brown, conspicuously marked with large, nearly orbicular, elevated leaf-scars and prominent lenticels, at length dark brown. Flower-buds ellipsoid, pubescent, nearly $\frac{1}{2}$ of an inch long, preformed the previous season, borne in large, upright, paniculate clusters. Leaf-buds semi-circular, compressed, light brown, $\frac{1}{8}$ of an inch long, the bud-scales spreading at the apex of the bud. Pith diaphragmed. Mature bark rather thick, dark grayish brown mottled with shallow, grayish white, anastomosing fissures.

Habitat—In waste places about the habitations of man. Prefers deep, rich, moist soils.

Range—Introduced from China. Now naturalized and hardy as far north as the latitude of New York City, ranging from this point to Florida and Texas.

Uses—Propagated in the eastern United States for its large, showy, fragrant flowers and large leaves which give a tropical effect. It will not flower regularly beyond the latitude of New York City. Farther north it usually winter-kills to the ground each season but will continue to send up vigorous sprouts for a number of years. A number of varieties are recognized. The soft, light wood is prized in the Orient.



Hardy Catalpa, Cigar Tree

Catalpa speciosa Ward. [*Catalpa cordifolia* Jaume, not Moench.]

- | | |
|---|----------------------------------|
| 1. A portion of an inflorescence x $\frac{1}{2}$ | 3. A mature leaf x $\frac{1}{2}$ |
| 2. A flower, lateral sectional view x $\frac{3}{4}$ | 4. Capsule x $\frac{1}{2}$ |
| | 5. Winged seed x $\frac{3}{4}$ |
| | 6. Winter twig x $\frac{1}{2}$ |

BIGNONIACEAE

Catalpa speciosa Ward. [*Catalpa cordifolia* Jaume, not Moench.]

Hardy Catalpa, Cigar Tree

Habit—In the Northeast generally a small or medium-sized tree 25—50 feet in height with a trunk 6—15 inches in diameter, farther west in the Ohio Basin reaching a maximum height of 120 feet with a trunk diameter of 4½ feet. In the open the bole is short and bears a broad, spreading crown. Trees in the forest possess tall, straight trunks and reduced crowns. Hardier than *Catalpa bignonioides* Walt.

Leaves—Opposite or 3 at a node, ovate to ovate-oblong, 10—12 inches long, 7—8 inches wide, long-pointed at the apex, rounded or cordate at the base, entire or with 1—2 lateral teeth, at maturity thick, firm, dark green above, paler and soft pubescent below and usually with a purplish glandular spot in the axils of the primary veins,* borne on stout, terete, pubescent petioles 4—6 inches in length. In contrast to the Common Catalpa, the foliage is not ill-scented when crushed.

Flowers—Appearing in June and early July after the leaves, perfect, showy, borne on slender, purple pedicels in terminal, few-flowered, open panicles 5—6 inches long. Calyx purple, about ½ of an inch long, divided to the base into 2 ovate, apiculate lobes. Corolla white spotted with purple-brown, 2—2½ inches long, with broad, campanulate tube and spreading, 5-lobed limb (2 small upper lobes and 3 larger lower lobes). Tube marked on the inner surface of the lower side with 2 rows of yellow blotches following 2 parallel ridges. Stamens 2, slightly exserted, with flattened, twisted filaments and oblong anthers borne vis-a-vis on either side of the stigma. Pistil consisting of a sessile, ovoid, 2-celled ovary abruptly contracted above into a slender, glabrous style bearing 2 stigmatic lobes at the apex. Ovules numerous, inserted in many series on a central placenta.

Fruit—A linear, subterete, dark brown, thick-walled capsule 8—20 inches long, ½—¾ of an inch thick at the center and tapering toward each end. The capsules are borne in thick-stemmed, persistent panicles and remain closed and persist on the trees most of the winter, eventually splitting into 2 concave valves before falling to set free the seeds. Seeds numerous, oblong, compressed, winged, inserted in 2—4 ranks near the margin of the woody septum and free from the capsule-wall. The wings entirely surround the seed and are extended longitudinally into fringed ends.

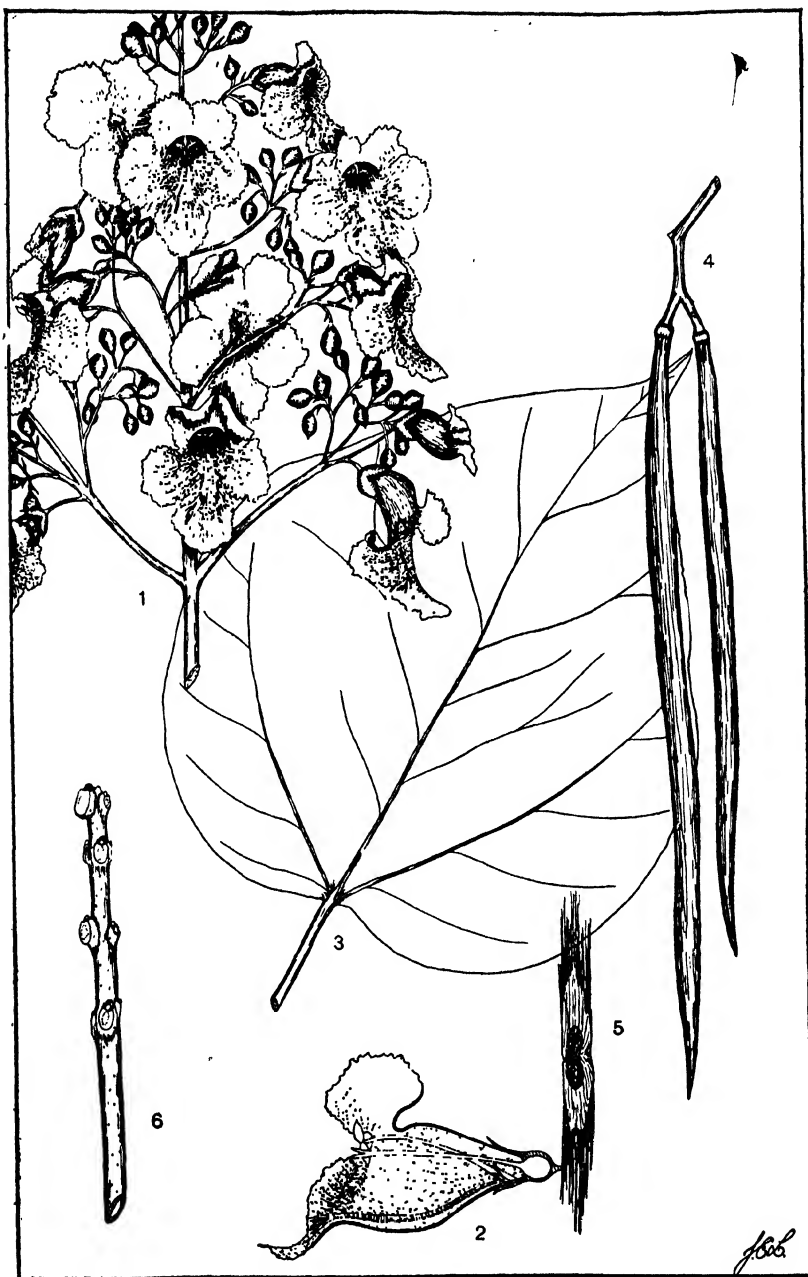
Winter characters—Twigs stout, smooth or somewhat downy, often covered with a slight bloom, reddish or yellowish brown, marked by numerous, conspicuous lenticels and raised, circular leaf-scars, usually winter-killing at the tip in the Northeast. Terminal bud absent. Lateral buds minute, hemi-spherical, chestnut-brown, imbedded in the bark. Bud-scales loosely imbricated. Pith large, white, homogeneous or chambered at the nodes. Mature bark, thin, reddish or grayish brown, broken by shallow fissures into longitudinal, flat ridges.

Habitat—Prefers rich, moist soils along stream courses and on bottom-lands. In the North it occasionally becomes naturalized about door-yards and abandoned homes.

Range—Southern Indiana and Illinois, western Kentucky and Tennessee, southeastern Missouri, and northeastern Arkansas. Now widely naturalized through cultivation in eastern United States.

Uses—Wood light, soft, not strong, coarse-grained, very durable in contact with the soil, grayish brown sometimes with a lavender tinge, with thin, nearly white sapwood. Used for railroad ties, fence posts, poles, etc. A profitable tree to grow in sections where the climate is not too rigorous, but not to be recommended for planting in the Northeast. Propagated as an ornamental tree both here and abroad.

*Honey bees visit these glands at certain seasons.



Common Catalpa, Indian Bean

Catalpa bignonioides Walt. [*Catalpa Catalpa* (L.) Karst.;
Catalpa syringaefolia Sims]

- | | |
|---|---|
| 1. A portion of an inflorescence x $\frac{1}{2}$ | 3. A mature leaf x $\frac{1}{2}$ |
| 2. A flower, lateral sectional view x $\frac{1}{4}$ | 4. Portion of fruit-cluster x $\frac{1}{2}$ |
| | 5. Winged seed x $\frac{3}{4}$ |
| | 6. Winter twig x $\frac{1}{2}$ |

BIGNONIACEAE

Catalpa bignonioides Walt. [*Catalpa Catalpa* (L.) Karst.;
Catalpa syringaeifolia Sims]

Common Catalpa, Indian Bean

Habit—In the North generally a small tree 20–40 feet in height with a trunk 6–15 inches in diameter, farther south in its natural range occasionally 65 feet in height with a trunk diameter of 3–4 feet. Bole short, bearing a high, broad, symmetrical crown consisting of coarse, sparse branches and dense foliage.

Leaves—Opposite or 3 at a node, broad-ovate, 5–6 inches long, 4–5 inches wide, abruptly contracted to an acuminate apex, cordate at the base, entire or sometimes laterally lobed, at maturity thin, light green and glabrous above, pale-pubescent below and usually with a purple glandular spot in the axils of the primary veins, borne on stout, terete petioles 5–6 inches in length. The foliage has an unpleasant odor when crushed.

Flowers—Appearing in June and early July after the leaves, perfect, showy, borne on slender, pubescent pedicels in terminal, many-flowered, compact panicles 8–10 inches long. Calyx green or purplish, $\frac{1}{2}$ of an inch long, cleft nearly to the base into 2 broad-ovate, entire lobes. Corolla white spotted with purple-brown, nearly 2 inches long, with broad, campanulate tube and spreading, 5-lobed limb (2 small upper lobes and 3 larger lower lobes). Tube marked on the inner surface of the lower side with 2 rows of yellow blotches following 2 parallel ridges. Stamens 2, slightly exserted, with flattened, twisted filaments and oblong anthers borne vis-a-vis on either side of the stigma. Pistil consisting of a sessile, ovoid, 2-celled ovary abruptly contracted into an elongate, filiform style bifurcated at the tip into stigmatic lobes which project beyond the anthers. Ovules numerous, inserted in many series on a central placenta.

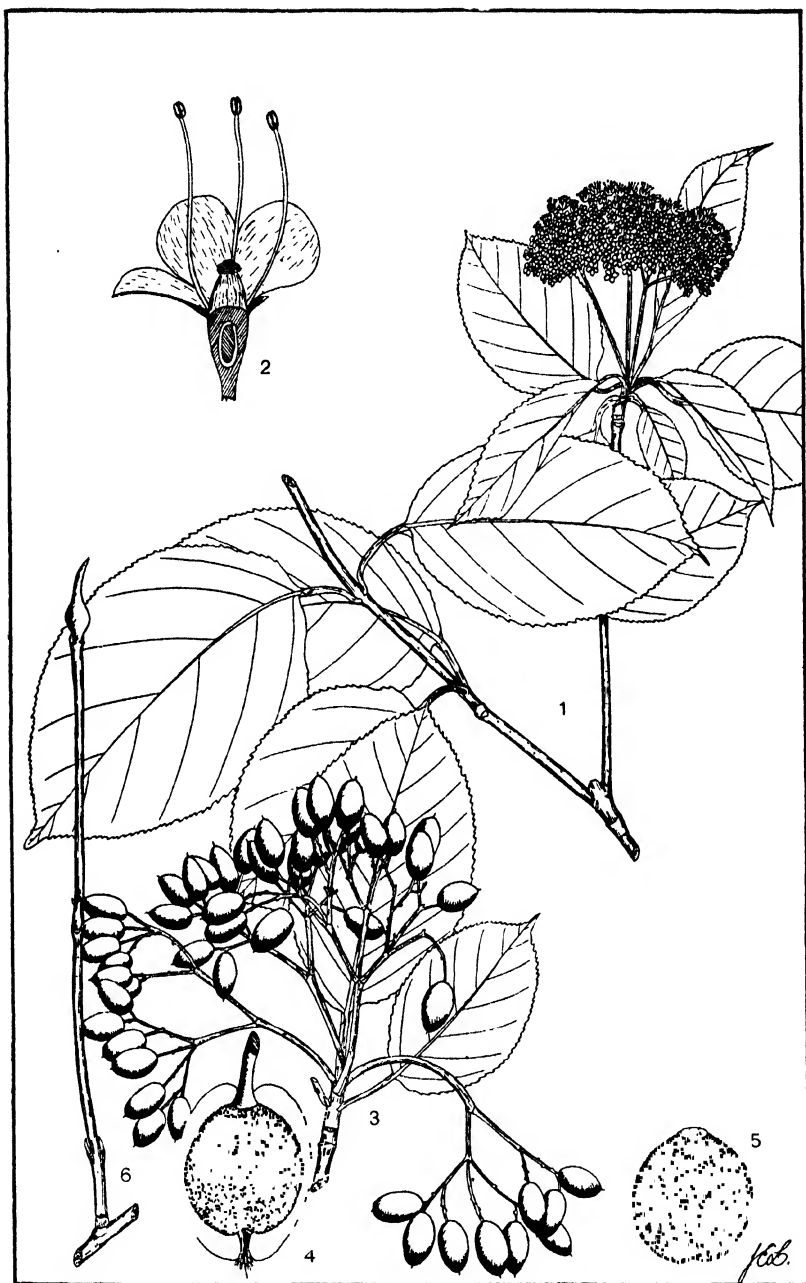
Fruit—A linear, subterete, bright chestnut-brown, thin-walled capsule, 6–20 inches long, $\frac{1}{4}$ – $\frac{1}{2}$ of an inch thick at the center and tapering toward each end. The capsules are borne in thick-stemmed, persistent panicles and remain closed and persist on the trees until spring, finally splitting into 2 concave valves before falling to set free the seeds. Seeds numerous, oblong, compressed, winged, inserted in 2–4 ranks near the margin of the woody septum and free from the capsule-wall. The wing entirely surrounds the seed and is extended longitudinally into fringed ends.

Winter characters—Twigs stout, lustrous or somewhat glaucous, yellowish brown, marked by numerous, large lenticels and raised, circular leaf-scars, usually winter-killing at the tip in the Northeast. Terminal bud absent. Lateral buds minute, hemi-spherical, chestnut-brown, imbedded in the bark, with loosely imbricated bud-scales. Pith large, white, homogeneous or chambered at the nodes. Mature bark thin, light brown tinged with red, divided by shallow fissures into large, thin, irregular scales.

Habitat—In the Northeast occurring as an 'escape' in rich, moist soils about the habitations of man, in its natural range found along stream courses and river banks, more rarely in drier situations.

Range—Western Georgia and Florida westward through Alabama and Mississippi; also in southwestern Missouri. Now extensively propagated in all parts of the United States east of the Rocky Mountains and hardy as far north as central New England.

Uses—Wood light, soft, not strong, coarse-grained, very durable in contact with the soil, grayish brown sometimes with a lavender tinge, with narrow, nearly white sapwood. Used for railroad ties, fence posts, poles, etc. Extensively propagated for its handsome foliage and showy flowers in the parks and gardens of the eastern United States, and in Europe. A number of ornamental varieties are recognized.



Nannyberry, Sheepsberry

***Viburnum lentago* L.**

- | | |
|---|--------------------------------------|
| 1. A branch showing inflorescence and mature leaves x 2 | 4. Fruit, lateral sectional view x 2 |
| 2. A flower, lateral sectional view x 5 | 5. Pit, lateral view x 2 |
| 3. A fruit-cluster x 1/2 | 6. Winter twig x 1/2 |

Viburnum lentago L.
Nannyberry, Sheepsberry

CAPRIFOLIACEAE

Habit—Generally a shrub 10—15 feet in height, occasionally a bushy tree 20—30 feet tall with a trunk diameter of 6—10 inches. Trunk usually short, soon breaking up into slender, ascending, tortuous branches which form a wide, rounded crown.

Leaves—Opposite, ovate to elliptic-obovate, 2—4 inches long, abruptly acuminate at the apex with a short or long point or sometimes rounded, cuneate or rounded at the base, sharply and finely serrate on the margin, at maturity thick, bright green and lustrous above, yellowish green with minute black dots and smooth below, borne on grooved, often winged petioles 1—1½ inches in length.

Flowers—Appearing in May and early June after the leaves in dense, sessile, many-flowered, several-rayed, terminal cymes 3—5 inches in diameter. Calyx-tube narrowly ovoid, adherent to the ovary, with 5 minute, persistent lobes. Corolla pale cream-colored or white, rotate, deeply 5-lobed. Stamens 5, exserted, inserted at the base of the corolla and alternate with its lobes, with long slender filaments and yellow anthers. Pistil consisting of an inferior, 1-celled ovary surmounted by a short, conic style bearing 3 stigmatic lobes at the apex.

Fruit—An ellipsoid, black or dark blue, glaucous, thick-skinned drupe, ⅓—½ of an inch long, borne on slender, reddish stalks in drooping clusters, ripening in September. Flesh sweet and rather juicy. Pit broadly oval, flattened, granular.

Winter characters—Twigs slender, somewhat scurfy, gray or light red, with scattered orange-colored lenticels, ill-smelling when broken. Terminal flower-buds lance-ovoid, long-pointed, about ¾ of an inch long, protected by a pair of opposite, gray or pale red, scurfy-pubescent scales. Terminal-shoot-buds long and narrow, otherwise similar to the flower-buds. Lateral buds lance-ovoid, flattened, appressed, much smaller than the terminal buds. Mature bark thin, reddish brown, divided by shallow fissures into small, irregular, scaly plates.

Habitat—In low, moist, fertile soils along stream courses and lake shores, occasionally in drier situations along fence rows.

Range—Quebec westward to Manitoba, southward to Georgia and Mississippi.

Uses—Of no economic value except as an ornamental plant. Propagated in parks and private estates for its showy, fragrant flowers, attractive foliage, and showy, edible, autumnal fruit. A variety, var. **sphaerocarpum** Gray, with subglobose fruits, is also grown as an ornamental. Wood very ill-scented, heavy, hard, fine textured, orange- or golden-brown with thin, nearly white sapwood.



Black-haw, Stag-bush

Viburnum prunifolium L. [*Viburnum pyrifolium* Poir.]

1. A twig showing inflorescence and immature leaves $\times \frac{1}{2}$
2. A flower, lateral sectional view $\times \frac{1}{4}$
3. A branch showing mature leaves and fruit $\times \frac{1}{2}$
4. Fruit, lateral sectional view $\times 1\frac{1}{2}$
5. Pit, lateral view $\times 1\frac{1}{2}$
6. Winter twig $\times \frac{1}{2}$

CAPRIFOLIACEAE

Viburnum prunifolium L. [*Viburnum pyrifolium* Poir.]

Black-haw, Stag-bush

Habit—A shrub or occasionally a small tree 20—30 feet in height with a trunk diameter of 6—8 inches. Trunk short, often crooked or inclined. Crown broad, round-topped, consisting of many rigid branches and spur-like branchlets.

Leaves—Opposite, broad-elliptic or occasionally ovate or obovate, 1—3 inches long, rounded, acute or short-pointed at the apex, acute or rounded at the base, serrulate, at maturity thick and somewhat coriaceous, dark green and glabrous above, paler and glabrous below, borne on grooved, glabrous, sometimes narrowly winged petioles $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long.

Flowers—Appearing in May after the leaves on slender pedicels in dense, many-flowered, sessile, terminal cymes 3—4 inches in diameter. Calyx-tube narrowly ovoid, adherent to the ovary, with short rounded lobes. Corolla white, rotate, about $\frac{1}{4}$ of an inch in diameter, divided deeply into 5 oval lobes. Stamens 5, exserted, inserted at the base of the corolla and alternate with its lobes, with long slender filaments and yellow anthers. Pistil consisting of an inferior, 1-celled ovary surmounted by a thick, conic style terminated by a broad stigma.

Fruit—An ovoid, short-ellipsoid, or slightly obovoid, dark blue or nearly black, glaucous drupe, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long, borne on slender, reddish stalks in drooping, few-fruited clusters, ripening in October. Flesh sweet and edible after the first autumnal frost. Pit oblong, compressed, about $\frac{1}{2}$ of an inch long.

Winter characters—Twigs rather slender, smooth and often covered with a slight bloom, gray tinged with red, marked by orange-colored lenticels and lunate leaf-scars. Spine-like branch-spurs usually very numerous. Terminal flower-buds ovoid, acute or obtuse, about $\frac{1}{4}$ of an inch long, protected by a single pair of reddish, pubescent scales. Terminal-shoot-buds narrower but otherwise similar to the flower-buds. Lateral buds lance-ovoid, flattened, appressed to the twig, about $\frac{1}{4}$ of an inch long. Mature bark thin, reddish brown, divided by shallow fissures into irregular, warty scales.

Habitat—Rather dry situations on gravelly hills, along fences and hedge rows, and about the margins of woods, often forming extensive thickets on abandoned lands.

Range—Connecticut to Michigan, south to Florida and Texas.

Uses—Black-haw is used as an ornamental plant throughout the arboretums and parks of eastern United States and Europe. The bark of the roots has medicinal value.

CONSPECTUS

OF THE FAMILIES AND GENERA WHICH INCLUDE THE NATIVE AND
NATURALIZED TREES OF THE NORTHEASTERN STATES WITH

ANALYTICAL KEYS

LEADING TO THE SPECIES

SUBDIVISION I. GYMNASPERMAE*

(NAKED-OVULED PLANTS)

Flowering plants in which the seeds are borne naked, that is, not inclosed in a ripened ovary or pericarp, the latter represented by a scale or this apparently wanting. The ovuliferous scales, where present, are usually aggregated into cones and spread at maturity to permit the escape of the seeds. Gymnosperms are all woody and include trees, shrubs, and lianas. Formerly represented in large numbers during the Triassic and Jurassic periods of the Mesozoic, the group has waned in recent times to about six hundred and fifty species which are grouped in four orders, the *Cycadales*, *Coniferales*, *Ginkgoales*, and *Gnetales*. Of these the *Coniferales* are most important because they include many forest trees which cover extensive tracts in temperate regions. The others are not represented among the native or naturalized trees of the Northeastern States.

ORDER CONIFERALES**

- A. Ovuliferous scales not forming a definite cone; seeds provided with
a partially fleshy testa or an aril.....Taxaceae
AA. Ovuliferous scales aggregated into definite cones; seeds ripening
dry Pinaceae

YEW FAMILY. TAXACEAE

Represented by twelve genera and some one hundred odd species, grouped in two tribes, the *Podocarpineae* and the *Taxineae*. The *Podocarpineae* are characteristic of the Southern Hemisphere and include valuable timber trees. The *Taxineae* are chiefly inhabitants of the Northern Hemisphere and are represented in the Northeast by but the one native species, *Taxus canadensis* Marsh., the Ground Hemlock.

PINE FAMILY. PINACEAE

The Pine Family of thirty-four genera and approximately three hundred and eighty species includes the dominant conifers of most regions.

*For Subdivision II, see page 403; the Gymnospermae and the Angiospermae are included in Division Spermatophyta of the Plant Kingdom.

**Pilger in Engler-Prantl, *Natürliche Pflanzenfamilien* divides the Coniferales into seven families.

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Aside from a few shrubs they are all arborescent and are most important in the Temperate Zones (the majority in the North Temperate Zone), a few occurring in the tropics. Certain species form almost pure stands of evergreen forest which cover extensive tracts.

Buds scaly. **Leaves** acicular, narrow-oblong, awl-shaped or scale-like, parallel-veined, solitary or fascicled, generally persistent. **Flowers** usually monoecious (dioecious in *Juniperus*), destitute of perianth, consisting of groups of sporophylls which are arranged spirally or cyclic in catkin-like clusters and bear ovules or pollen sacs on their faces; flowers usually subtended by an involucre of enlarged bud-scales; scales of male cones bearing 2-several anther sacs; scales of ovulate cones bearing 2 or more (rarely 1) ovules on the inner face. **Fruit** a woody or rarely a fleshy (*Juniperus*) cone consisting of indurated or fleshy scales; seeds often winged, copiously albuminous; embryo axile, with 2 or more cotyledons.

KEY TO THE GENERA

| | Page |
|---|--------------------------|
| 1. Leaves spirally arranged or borne in fascicles..... | 2 |
| 1. Leaves all opposite in pairs..... | 6 |
| 2. Leaves acicular, born in fascicles of 2—5..... | Pinus 396 |
| 2. Leaves linear or filiform, fascicled or scattered..... | 3 |
| 3. Leaves fascicled on short spurs and scattered spirally on the growth of the season; foliage deciduous..... | Larix 398 |
| 3. Leaves spirally arranged; foliage persistent..... | 4 |
| 4. Leaves 4-sided, harsh and prickly to the touch, not prominently white-lined on the lower side..... | Picea 398 |
| 4. Leaves flattish, with soft feel, whitened along two prominent lines beneath..... | 5 |
| 5. Leaves jointed to persistent woody stalks; branchlets roughened by persistent leaf-bases..... | Tsuga 399 |
| 5. Leaves sessile, leaving round leaf-scars on falling; branchlets smooth..... | Abies 400 |
| 6. Sprays flattened; branchlets appearing in one plane..... | 7 |
| 6. Sprays not flattened; branchlets spreading..... | Juniperus 401 |
| 7. Leaves of 2 sorts; young twigs prominently flattened..... | Thuja 400 |
| 7. Leaves all alike; young twigs not prominently flattened..... | Chamaecyparis 401 |

THE PINES. Genus *PINUS* L.

The genus *Pinus* is represented by evergreen trees and a few shrubs which are natives of the Northern Hemisphere and chiefly of temperate regions. Many species are of great economic importance as timber trees and cover extensive tracts, often in nearly pure stands. About eighty species are recognized of which thirty-five are indigenous to the United States. Six native species are found within the area

KEY TO GENERA AND SPECIES

covered by this text and Scots Pine (*P. sylvestris* L.) of Europe and North Asia has become sparingly naturalized, especially near forest plantations.

Leaves evergreen, acicular, in fascicles of 2—5 (rarely 1 or up to 8) which are borne on rudimentary branches in the axils of primary scale-leaves; fascicles arising from scaly buds, the scales of which lengthen and form a more or less persistent sheath at the base of the fascicle. **Flowers** vernal, monoecious; staminate flowers clustered at the base of the growth of the season, each flower subtended by an involucre of 3—6 scale-like bracts; stamens numerous, spirally arranged and imbricated, the 2 pollen sacs terminated by a crest-like, nearly orbicular connective; ovulate flowers conical or cylindrical, consisting of spirally arranged, imbricated, ovuliferous scales borne in the axils of non-acrescent bracts; ovules 2, inverted. **Fruit** a pendent, woody cone, maturing at the end of the second or rarely of the third season, consisting of the enlarged and indurated scales of the ovulate flower which are thickened and sometimes awned at the end; at maturity the cone-scales dry out and sprad to liberate the 2 nut-like, winged seeds; cotyledons 4—15, linear.

KEY TO THE SPECIES

| | Page |
|--|-------------------------|
| 1. Leaves in fascicles of 5; cones cylindrical, 4—10 inches long..... | 87 |
| P. strobus | |
| 1. Leaves in fascicles of 2—3; cones conical to oblong- or ovoid-conical | 2 |
| 2. Leaves in fascicles of 3..... | 3 |
| 2. Leaves in fascicles of 2..... | 4 |
| 3. Leaves somewhat rigid; cone-scales armed with stout prickles.... | |
| Pinus rigida | 89 |
| 3. Leaves soft and flexible; cone-scales armed with weak prickles.... | |
| P. echinata | 91 |
| 4. Leaves 3—6 inches long..... | 5 |
| 4. Leaves $\frac{3}{4}$ —3 inches long..... | 7 |
| 5. Leaves flexible, not noticeably twisted..... | 6 |
| 5. Leaves stout, usually twisted..... | P. sylvestris 93 |
| 6. Cone-scales unarmed; young cones subterminal..... | P. resinosa 95 |
| 6. Cone-scales with slender prickles; young cones lateral..... | |
| P. echinata | 91 |
| 7. Leaves $1\frac{1}{2}$ —3 inches long..... | 8 |
| 7. Leaves $\frac{3}{4}$ — $1\frac{1}{4}$ inches long..... | P. banksiana 97 |
| 8. Spur-shoots uninodal (with only one whorl of branches)..... | |
| P. sylvestris | 93 |
| 8. Spur-shoots multinodal (with more than one whorl of branches | |
| P. virginiana | 99 |

The various species of pines fall into two groups, the *Soft* and the *Hard* Pines, which are characterized as follows:

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Soft Pines—Wood soft and light, even-grained, light-colored; transition from spring- to summerwood gradual; fascicle-sheaths deciduous; leaves with one vascular bundle. Ex. *Pinus strobus* L.

Hard Pines—Wood usually hard and heavy, uneven-grained, generally dark colored; transition from spring- to summerwood abrupt; fascicle-sheaths persistent; leaves with two vascular bundles. Exs. *Pinus rigida* Mill.; *Pinus virginiana* Mill.; *Pinus banksiana* Lamb.; *Pinus echinata* Mill.; *Pinus resinosa* Ait.; *Pinus sylvestris* L.

THE LARCHES OR TAMARACKS. Genus *LARIX* Mill.

Larix is a genus of ten species of trees which are widely distributed over the northern and mountainous regions of the Northern Hemisphere, both in the New and the Old World. They produce hard, heavy, strong and durable wood which is valuable for structural purposes. Three species are indigenous to the United States, one of which, *L. laricina* (Du Roi) Koch., occurs in the Northeast. European Larch (*L. decidua* Mill.) has been introduced for forest planting and as an ornamental, and shows indications of becoming naturalized.

Leaves deciduous, narrowly linear, triangular or rarely 4-sided, rounded above, keeled and stomatiferous beneath, borne solitary in spirals on the leading shoots and in sheathless fascicles on short spurs on the older growth, turning yellow before falling in the autumn. **Flowers** solitary, terminal, monoecious, appearing with the leaves; staminate flowers oval, globose, or oblong, yellow, sessile or stalked, consisting of numerous, spirally arranged stamens, each with 2 pollen sacs and apiculate connective; ovulate flowers subglobose, consisting of a few or many, nearly orbicular, stalked, green, ovuliferous scales subtended by scarlet, projecting, mucronate bracts; ovules 2, inverted. **Fruit** an ovoid-oblong, woody, short-stalked, erect cone, maturing the first season; cone-scales thin, concave, reduced to sterile bracts at the base of the cone; seeds nearly triangular, shorter than their wings; cotyledons about 6.

KEY TO THE SPECIES

- | | |
|---|------------------------|
| | Page |
| 1. Cones globose-ovoid, $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long; cone-scales 12—15 in number, glabrous outside | <i>L. laricina</i> 101 |
| 1. Cones ovoid, $\frac{3}{4}$ —1 $\frac{1}{2}$ inches long; cone-scales 40—50 in number, tomentulose outside below the middle | <i>L. decidua</i> 103 |

THE SPRUCES. Genus *PICEA* A. Dietr.

The genus *Picea* consists of about forty species confined wholly to the cooler parts of the North Temperate and Subarctic Zones, often forming extensive forests on mountain slopes and plains. Seven species are native to North America, three of which occur in the Northeast.

KEY TO GENERA AND SPECIES

Norway Spruce (*P. abies* Karst.) has been introduced for forest planting and as an ornamental tree, and is grown extensively.

Leaves persistent, linear, 4-sided, stomatiferous on all faces, spirally arranged and coming out from all sides of the twig or occasionally appearing 2-ranked due to a twist in the petiole, articulated to persistent leaf-bases. **Flowers** terminal or in the axils of the upper leaves, monoecious, vernal; staminate flowers cylindrical, usually long-stalked and subtended at the base by accrescent bud-scales, consisting of numerous, spirally arranged stamens with 2 pollen sacs and a connective produced distally into a broad, nearly circular, toothed crest; ovulate flowers oblong, oval, or cylindrical, the ovuliferous scales rounded or pointed and subtended by bracts; ovules 2, inverted. **Fruit** an ovoid or oblong-cylindrical, pendent, woody cone, maturing the first season, generally crowded on the uppermost branches; cone-scales thin, concave, unarmed, entirely concealing the bracts at maturity; seeds ovoid or oblong, acute at the base, much shorter than their wings; cotyledons 5—10.

KEY TO THE SPECIES

- | | Page |
|---|-----------------------|
| 1. Cones $\frac{1}{2}$ —2 inches long; cone-scales rounded..... | 2 |
| 1. Cones 4—6 inches long; cone-scales rhombic-ovate with a truncate or emarginate apex | P. abies 105 |
| 2. Cones cylindric-oblong; branchlets glabrous and usually glaucous | P. glauca 107 |
| 2. Cones ovoid to ovoid-oblong; branchlets pubescent..... | 3 |
| 3. Foliage yellowish green or dark green; cones ovoid-oblong, reddish brown; cone-scales with entire margins..... | P. rubens 109 |
| 3. Foliage bluish green and glaucous; cones ovoid, dull ashy-brown; cone-scales with erose margins | P. mariana 111 |

THE HEMLOCKS. Genus TSUGA Carr.

Tsuga is represented by about fourteen species which are scattered over temperate North America, Japan, central and western China, and the Himalaya. Four species occur in the United States, two eastern and two western forms respectively. The hemlocks are trees with pyramidal crown, horizontal or drooping branches, and horizontal, flat sprays of foliage. The bark is rich in tannin.

Leaves persistent, linear, flat or angular, acute, obtuse or emarginate at the apex, stomatiferous in two white bands below or on both faces in *Tsuga mertensiana* Sarg., spirally arranged but usually appearing 2-ranked by a twisting of the petiole, those on the upper side of the branchlet much shorter, abruptly narrowed into short petioles which are articulated to woody, persistent bases. **Flowers** monoecious, solitary, vernal; staminate flowers subglobose, axillary, composed of numerous, spirally arranged stamens with subglobose anthers and a connective produced into an apiculate tip; ovulate flowers oblong to cylindric, erect, terminal; ovuliferous scales nearly orbicular, somewhat longer than the subtending bracts; ovules 2, inverted. **Fruit** an ovate-oblong to oblong,

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pendent, sessile or short-stalked, woody cone, maturing the first season and opening tardily during the winter; seeds ovate-oblong, acute at the base, smaller than the wings; cotyledons 3—6. ***Tsuga canadensis*** (L.) Carr. occurs in the Northeast.

THE FIRS. Genus *ABIES* Mill.

Under optimum conditions the firs are tall, pyramidal trees with slender, horizontal, wide-spreading branches in regular, remote whorls of 4—5. The bark is smooth when young, and contains numerous resin-vesicles. Approximately forty species are now recognized which are all natives of the Northern Hemisphere, chiefly of cooler regions, and are scattered through North America, Japan, Asia, Europe, and northern Africa. Seven species are found in western United States (eight according to Sudworth's Check List) and two occur in the Atlantic States.

Leaves persistent, spirally aranged, often spreading in two ranks, linear or linear-lanceolate, flattened and grooved above, generally with two white stomatiferous bands below (some species also with stomata above), rarely 4-sided (certain species, and on vigorous shoots and fertile branches) and then with stomata on all four sides. The leaves persist 8—10 years and in falling leave circular scars flush with the surface of the twig. **Branch-buds** usually resin-coated. **Flowers** axillary, monoecious, surrounded at the base by accrescent bud-scales; staminate flowers numerous on the lower side of branches above the middle of the tree, oval or oblong-cylindrical, composed of numerous, spirally arranged stamens with 2 anthers and a connective ending in a knob; ovulate flowers erect on the upper side of branchlets, usually confined to the topmost branches, globose or oblong-cylindrical, consisting of spirally arranged, ovuliferous scales subtended but not overtopped by mucronate bracts; ovules 2, inverted. **Fruit** an ovoid or oblong-cylindrical, erect cone, maturing the first season; ovuliferous-scales numerous, broad, thin, subtended by a thin, membranous bract which projects beyond the ovuliferous scale in some species; at maturity the ovuliferous scale, bract, and seeds fall away from the upright, persistent cone-axis; seeds ovoid or oblong, winged; cotyledons 4—10. The genus is represented in the Northeast by ***Abies balsamea*** (L.) Mill., the Balsam Fir.

THE ARBOR-VITAE. Genus *THUJA* L.

The Arbor-vitae are resinous, evergreen trees with pyramidal crowns, flat, fan-shaped, 2-ranked sprays of foliage, soft, even-grained, durable wood, and thin fibrous bark. The genus embraces six species and is confined to northern North America, Japan, and eastern Asia. Two species are indigenous to North America, the western species, a valuable timber tree of the Pacific Slope and Northern Rockies, the eastern species confined to the Atlantic States and Canada.

Leaves persistent, small, scale-like, decussate, acute, imbricated in 4-

KEY TO GENERA AND SPECIES

rows, stomatiferous on the back; on leading shoots, they are rounded on the back and narrowed to long points; on lateral flattened shoots, the lateral rows are strongly keeled, much compressed, and nearly cover the central rows. **Flowers** terminal, minute, monoecious, the two kinds generally on different branches; staminate flowers subglobose, composed of 4—6 decussate stamens, each consisting of a peltate connective and 4—6 anthers; ovulate flowers oblong or ovoid, consisting of 8—12 oblong, acute, decussate scales, the ovuliferous inner scales with 2 erect, bottle-shaped ovules. **Fruit** a small, oblong-ovoid cone which matures the first season, consisting of a few, thin, leathery scales, only the inner of which are fertile; seeds oblong, compressed, laterally winged; cotyledons 2. The genus is represented in the Northeast by *Thuja occidentalis* L.

THE COAST CEDARS. Genus CHAMAECYPARIS Spach.

The genus *Chamaecyparis* includes tall, evergreen trees with pyramidal crowns, spreading branches, fan-like sprays of foliage, and even-grained, durable wood. Six species have been described, confined to North America, Japan, and Formosa. Two of the North American species are found on the Pacific Coast. The Coast White Cedar, *C. thyoides* (L.) B. S. P., occurs along the Atlantic Coast from Maine southward to Florida and the Gulf States.

Leaves persistent, very small, scale-like, ovate, acuminate, appressed or with spreading tips, decussate, on vigorous shoots often acicular or linear and spreading. **Flowers** monoecious, terminal, minute, the two sexes on different branches; staminate flowers oblong, consisting of numerous decussate stamens, each with ovate connective and 2 anther sacs; ovulate flowers subglobose, consisting of decussate, peltate scales, the fertile bearing 2—5 erect, bottle-shaped ovules. **Fruit** a small, erect, globose cone, maturing the first season but persisting on the branchlets; cone-scales thick, peltate, centrally embossed, the fertile bearing 1—5 compressed, laterally winged seeds at the base; cotyledons 2.

THE JUNIPERS. Genus JUNIPERUS L.

The Junipers are pungent-aromatic, evergreen trees and shrubs of the Northern Hemisphere with slender branches, medium hard, firm, fine-grained and extremely durable wood, and thin, shreddy bark. The fifty-odd representatives of this genus are widely distributed through the Northern Hemisphere from the Arctic Zone to the mountains of the Tropics. One shrubby species, the Common or Dwarf Juniper, *Juniperus communis* L., is circumpolar in distribution and is frequent in certain sections of northern New York and New England. Twelve species become arborescent within the boundaries of the United States one of which, *J. horizontalis* L., occurs within the range of this text.

Leaves trimorphic; one sort in whorls of 3, linear-subulate, acute, non-

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glandular, convex below, concave and stomatiferous above; a second kind scale-like, ovate, opposite or ternate, closely imbricated, appressed adnate to the branch, glandular on the back on lateral shoots; the third sort free and awl-shaped, borne on vigorous shoots. **Flowers** dioecious, axillary or terminal, minute; staminate flowers solitary, oblong-ovate, consisting of numerous stamens decussate or in 3's, each with an ovate or peltate connective and 2—6 pollen sacs; ovulate flowers ovoid, bracteolate at the base, consisting of 2—6 opposite or ternate scales bearing minute, 1-2-ovuled, fertile scales on their inner face. **Fruit** a berry-like, succulent, blue-black, blue or red cone, often with glaucous bloom, smooth or marked by the tips of the coalescing scales, containing 1—6 bony, wingless seeds; cotyledons 2—6. The cones require 1—3 years to attain maturity.

SUBDIVISION II. ANGIOSPERMAE

(PLANTS WITH OVULES ENCLOSED IN AN OVARY)

Flowering plants in which the ovules are borne enclosed in an ovary which remains closed in fruit or dehisces to set free the seeds. This subdivision includes the great bulk of the typical flowering plants which number approximately 151,000 species and are widely spread over the earth wherever plants grow. The essential feature of this group which separates it from the Gymnosperms is the presence of the pistil in the flower, in addition to stamens. Angiosperms are of more recent origin than Gymnosperms and include both herbaceous and woody types.

The *Angiospermae* are divided into two classes which are characterized, viz.:

Dicotyledons with (a) lateral cotyledons (generally two); (b) vascular bundles or tissue in a ring; (c) open venation; (d) 4- or 5-merous flowers.

Monocotyledons with (a) a single terminal cotyledon; (b) vascular bundles scattered in the stem; (c) closed venation; (d) 3-merous flowers.

Dicotyledonous plants include among their numbers herbs, shrubs and trees; arborescent forms are found in all regions from beyond the Arctic Circle to the Equator. Arborescent monocotyledons are confined to warm climates and are represented by Palms, Yuccas, etc., some of which grow in the warmer parts of the United States.

CLASS I. DICOTYLEDONS

The *Dicotyledons* number at least 120,000 species and comprise by far the greater part of the flowering plants. All of the arborescent plants of northern regions, with the exception of the coniferous trees, are included in this group which is interspersed with many herbaceous forms. *Dicotyledons* are more primitive than *Monocotyledons* and are thought to have been derived from ancestral forms of Gymnosperms during the lower Cretaceous.

SUBCLASS I. APETALAE

Dicotyledons in which the corolla is wanting; calyx may or may not be present.

WILLOW FAMILY. SALICACEAE

Trees or shrubs with brittle twigs, alternate, simple leaves, aments of dioecious flowers, soft light wood, and bitter bark. The Family in-

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cludes but two genera, *Salix* comprising the willows and osiers, and *Populus*, the aspens and cottonwoods.*

Leaves alternate, deciduous, simple, stipulate (stipules often caducous). **Flowers** dioecious, without perianth, borne solitary in the axils of scales in axillary aments which appear before or after the leaves in spring; staminate flowers consisting of 1-many stamens inserted on a receptacle, subtended by a gland-like or cup-shaped disk; anthers 2-celled, longitudinally dehiscent; pistillate flowers consisting of a pistil with a 1-celled ovary surmounted by a short style and 2—4-lobed stigma; ovules numerous. **Fruit** a 1-celled, 2—4-valved, ovoid capsule bearing numerous, minute, comose, exalbuminous seeds.

KEY TO THE GENERA

| | Page |
|---|--------------------|
| 1. Scales of the ament entire; disk minute, glandular; buds with a single scale | <i>Salix</i> 404 |
| 1. Scales of the ament laciniate; disk cup-shaped; buds with numerous scales | <i>Populus</i> 405 |

THE WILLOWS. Genus SALIX L.

The genus *Salix* includes about three hundred species of trees and shrubs, widely scattered throughout the Northern Hemisphere, a few forms occurring south of the Equator. They thrive along stream banks and on moist bottomlands, and invade alpine summits and subarctic regions as scraggly, dwarfed shrubs. Approximately seventy species occur in North America, twenty-four of which are recognized as trees. A number of European species have been introduced for ornament and have become widely naturalized in eastern United States. Hybrids between European and native species are common.

Leaves alternate, simple, lanceolate to linear or obovate, short-petioled; stipules conspicuous, oblique, serrate and persistent, or small and caducous. **Flowers** dioecious, borne in aments, with entire bracts and minute, gland-like, nectiferous disk; staminate flowers consisting of 1—12 stamens (generally 2 or 5) inserted at the base of the scale, with slender, mostly free filaments and small, oblong anthers; pistillate flowers consisting of a sessile or short-stalked, 1-celled ovary surmounted by a short style and 2-cleft or entire, more or less curved stigmas; ovules numerous. **Fruit** an acuminate capsule opening by 2 recurved valves, maturing in late spring or early summer; seeds minute, comose, exalbuminous. **Winter buds** covered with a single scale.

*Two new genera, *Chosenia* and *Toisusu*, have recently been described from the Orient.

KEY TO GENERA AND SPECIES

KEY TO THE SPECIES

| | Page |
|--|----------------------------|
| 1. Stamens 1—2 | 2 |
| 1. Stamens 3 or more (generally 5) | 7 |
| 2. Capsules glabrous | 3 |
| 2. Capsules silky or tomentose | 5 |
| 3. Mature leaves with pale silky-pubescent on both sides..... | |
| S. alba var. vitellina | 123 |
| 3. Mature leaves glabrous or essentially glabrate | 4 |
| 4. Branches long and drooping; capsules sessile..... | S. babylonica 125 |
| 4. Branches not drooping; capsules short-pedicelled..... | S. fragilis 127 |
| 5. Filaments united; capsule sessile | S. purpurea 129 |
| 5. Filaments separate; capsule pedicelled | 6 |
| 6. Mature leaves glabrous and glaucous beneath; pedicel of capsule shorter than the scale | S. discolor 131 |
| 6. Mature leaves pubescent and somewhat glaucous beneath; pedicel of capsule longer than the scale | S. bebbiana 133 |
| 7. Leaves without petiolar glands; sterile aments elongated, slender-cylindrical | 8 |
| 7. Leaves with petiolar glands; sterile aments short-cylindrical or ellipsoid-ovoid | 9 |
| 8. Leaves pale or glaucous beneath; petioles generally $\frac{1}{2}$ of an inch or more in length | S. amygdaloides 135 |
| 8. Leaves green beneath; petioles less than $\frac{1}{2}$ of an inch in length | S. nigra 137 |
| 9. Leaves ovate-lanceolate or lanceolate, attenuate-acuminate at the apex | S. lucida 139 |
| 9. Leaves ovate or oblong-ovate, acuminate at the apex | S. pentandra 141 |

THE POPLARS AND COTTONWOODS. Genus POPULUS L.

Trees of rapid growth and large size, with scaly, generally resinous buds, long-petioled leaves, fugacious stipules, and bark which is at first smooth but eventually furrowed. Some thirty-odd species have been described, natives of the Northern Hemisphere and ranging from the Arctic Circle to the Tropics. Fifteen species occur within the boundaries of the United States.

Leaves alternate, simple, ovate-lanceolate to orbicular and deltoid, long-petioled; stipules minute, fugacious. **Flowers** dioecious, borne in aments, each flower subtended by a fimbriate, caducous scale and cup-shaped, oblique disk; staminate flowers consisting of 4—60 stamens, with short free filaments and purplish anthers; pistillate flowers consisting of a sessile, 1-celled ovary surmounted by a short style and 2—4 entire or 4-lobed stigmas; ovules numerous. **Fruit** a subglobose or ovoid-oblong capsule subtended by the persistent disk, maturing in the late spring or early summer and dehiscing by 2—4 recurved valves; seeds minute,

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comose, exalbuminous. **Winter buds** covered with a number of scales, generally resinous.

KEY TO THE SPECIES

| | Page |
|---|--|
| 1. Petioles conspicuously flattened | 2 |
| 1. Petioles terete or nearly so | 5 |
| 2. Leaves deltoid or deltoid-ovate | 3 |
| 2. Leaves ovate to orbicular | 4 |
| 3. Leaves deltoid-ovate, coarsely crenate-serrate with glandular, in-curved teeth; base of leaf-blade glandular | P. deltoides 143 |
| 3. Leaves rhombic-ovate, finely crenate-serrate; base of leaf-blade usually eglandular | X P. canadensis var. eugenei 145 |
| 4. Leaves 3—6 inches in diameter; margin coarsely dentate..... | P. grandidentata 147 |
| 4. Leaves 1½—3 inches in diameter; margin finely serrate..... | P. tremuloides 149 |
| 5. Petioles hairy; leaves not rusty below | 6 |
| 5. Petioles glabrous; leaves rusty below..... | P. tacamahaca 151 |
| 6. Leaves smooth below | 7 |
| 6. Leaves white-tomentose below | 8 |
| 7. Leaves 3—6 inches long, lustrous above, ciliate on the margin..... | P. candicans 153 |
| 7. Leaves 4—8 inches long, dull above, not ciliate on the margin..... | P. heterophylla 155 |
| 8. Leaves suborbicular to broadly ovate, irregularly sinuate-dentate | P. alba 157 |
| 8. Leaves nearly orbicular, palmately 3—5 lobed.... | P. alba var. nivea 157 |

WALNUT FAMILY. JUGLANDACEAE

The Walnut Family consists of aromatic trees with watery juice, alternate, estipulate, odd-pinnately compound, deciduous leaves, monoecious flowers, and drupaceous fruit enclosing a nut. Six genera and about 40 species are recognized, the majority in the warmer parts of the North Temperate Zone, some in South America. Two genera occur in North America, each of which is represented in the Northeast.

Leaves alternate, deciduous, odd-pinnate, estipulate, with long, grooved petioles; leaflets sessile or subsessile aside from the terminal, arranged in pairs along the rachis. **Flowers** monoecious, appearing after the leaves; staminate flowers in elongated, drooping aments on the growth of the previous season or at the base of the growth of the season, each flower in the axil of a bract; calyx 3—6-lobed, adnate to the subtending bract; pistillate flowers in terminal spikes or terminal and solitary, generally subtended by a bract and 2 bracteoles; calyx 3—5-lobed, adnate to the ovary; pistil consisting of a 1-celled or incompletely 3—4-celled, 1-ovuled ovary terminated by a short style and 2 plumose stigmas. **Fruit** drupaceous, the exocarp (husk) indehiscent or 4-valved, enclosing a bony nut; seed large, solitary, 2-lobed, oily, exalbuminous.

KEY TO GENERA AND SPECIES

KEY TO THE GENERA

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|---|--------------------|
| 1. Staminate aments simple, sessile or short-stalked; husk of the nut indehiscent; pith diaphragmed | Juglans 407 |
| 1. Staminate aments branched, long-stalked; husk of the nut 4-valved; pith homogeneous | Carya 407 |

THE WALNUTS AND BUTTERNUTS. Genus JUGLANS L.

Trees with spreading crowns, stout branches, superposed buds, diaphragmed pith, and alternate, odd-pinnate leaves with sessile or nearly sessile leaflets. About fifteen species are known, six of which occur in the United States, two in the eastern states, two in the Pacific Coast region, and two in the Southwest.

Leaves alternate, odd-pinnately compound, consisting of 11—17 sessile or nearly sessile leaflets; leaflets oblong-lanceolate, acute at the apex, inequilateral at the base, finely serrate except at the base, arranged aside from the terminal in pairs along a stout, pubescent petiole. **Flowers** monoecious, vernal; staminate flowers in drooping, cylindric aments 3—6 inches long borne on the twigs of the previous season; perianth 3—6-lobed; stamens 8—40 in 2 or more series; pistillate flowers in few-flowered spikes terminating the growth of the season; perianth adnate to the ovary, 4-lobed; petals 4, small, adnate to the ovary at the sinuses; pistil consisting of a usually 2-celled ovary, a short style, and 2 plumose stigmas. **Fruit** globose or ovoid, drupaceous, with fibrous, somewhat fleshy, indehiscent exocarp, and thick-walled, bony, rugose or sculptured, indehiscent endocarp, or the endocarp finally splitting into two valves; seed exalbuminous, deeply lobed, oily, edible.

KEY TO THE SPECIES

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| 1. Leaflets 13—23; fruit globose or slightly pyriform, not viscid..... | J. nigra 159 |
| 1 Leaflets 11—19; fruit ovoid-oblong, pointed, viscid..... | J. cinerea 161 |

THE HICKORIES. Genus CARYA Nutt. [Hicoria Raf.]

Trees with aromatic watery sap, tough flexuous branches, alternate odd-pinnately compound leaves, tough elastic wood, and homogeneous pith. Except for one species in China the genus is restricted to temperate North America. Fifteen species occur in eastern United States seven of which are found within the range of this text.

Leaves alternate, odd-pinnately compound; leaflets ovate or obovate, generally acuminate, inequilateral at the base, serrate, sessile or short-stalked aside from the terminal and arranged in pairs long a rachis. **Flowers** monocious, vernal; staminate flowers in slender, drooping aments in pedunculate clusters of 3 on the base of the growth of the season or near the summit of the growth of the preceding season; perianth adnate to the bract, 2—3-lobed or cleft; stamens 3—10; pis-

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tillate flowers in 2—10-flowered, terminal spikes; perianth unequally 4-lobed, adnate to the ovary; stigmas short-papillos. **Fruit** subglobose, oblong, ovoid or pyriform, drupaceous, with dehiscent, 4-valved exocarp and a bony endocarp which is 4-celled at the base and 2-celled at the apex. Seed variously lobed, exalbuminous, oily, generally edible.

KEY TO THE SPECIES

| | Page |
|--|---|
| 1. Upper three leaflets conspicuously larger than the others..... | 2 |
| 1. Upper three leaflets not conspicuously larger than the others..... | 5 |
| 2. Leaflets generally 5, glabrous or puberulous below..... | 3 |
| 2. Leaflets generally 7 | 4 |
| 3. Fruit 1—2½ inches long | C. ovata 163 |
| 3. Fruit ¾—1 inch long | C. ovata var. nuttallii 165 |
| 4. Leaves soft-pubescent below; fruit 1¾—2½ inches long..... | |
| C. laciniosa 167 | |
| 4. Leaves essentially glabrous below; fruit 1—1¼ inches long | |
| C. ovalis 169 | |
| 5. Leaflets glabrous or nearly so below; leaf-rachis smooth; involucre (husk) generally splitting only to the middle | 6 |
| 5. Leaflets pubescent below; leaf-rachis pubescent; involucre (husk) splitting to the base or nearly to the base | C. tomentosa 171 |
| 6. Leaflets chiefly 5 or 7, oblong or obovate-lanceolate; fruit pyriform to ovoid; shell thick | C. glabra 173 |
| 6. Leaflets chiefly 9, lanceolate or oblong-lanceolate; fruit ellipsoid; shell thin | C. cordiformis 175 |

BIRCH FAMILY. BETULACEAE

Trees or shrubs with watery juice, alternate, petioled, simple, stipulate leaves, monoecious or rarely dioecious flowers, and a fruit which is a small winged or unwinged nut. The *Betulaceae* are indigenous to the cooler portions of the Northern Hemisphere and include 6 genera and over one hundred species. Four genera are represented by arborescent forms in the Northeastern States.

Leaves alternate, deciduous, simple, stipulate (stipules generally fugacious), penniveined. **Flowers** monocious, vernal, appearing before or with the leaves; staminate flowers in elongated pendulous lateral aments, borne in clusters of 1—6 in the axils of bracts; perianth present or wanting; stamens 2—20, erect, inserted on a receptacle, with short filaments and oblong anthers; pistillate flowers in short, spike-like or capitate aments, borne in clusters of 1—3 in the axils of bracts; perianth present or wanting; pistil consisting of a 2-celled ovary terminated by a 2-cleft style, the lobes stigmatic at the apex or on the inner surface; ovule solitary, pendulous. **Fruit** a small, mostly 1-celled, 1-seeded nutlet which is winged in some genera; nutlets subtended by bracts (usually enlarged) which form a strobile or are grouped in a head or an elongated cluster; seed small, exalbuminous; cotyledons fleshy.

KEY TO GENERA AND SPECIES

KEY TO THE GENERA

| | Page |
|---|---------------------|
| 1. Staminate flowers solitary in the axils of ament-scales; nutlet with a foliaceous or saccate involucre | 2 |
| 1. Staminate flowers in 3's in the axils of the ament-scales; nutlet without a foliaceous involucre | 3 |
| 2. Involucre saccate, enclosing the nutlet; staminate aments exposed during the winter | Ostrya 409 |
| 2. Involucre foliaceous, 3-cleft; staminate aments enclosed in buds during the winter | Carpinus 409 |
| 3. Scales of fruiting strobiles thin, 3-lobed, deciduous from the axis of the strobile | Betula 410 |
| 3. Scales of the fruiting strobiles woody, 5-toothed or erose, persistent on the axis of the strobile | Alnus 411 |

THE HOP-HORNBEAMS. Genus *OSTRYA* Scop.

A genus of wide distribution throughout the Northern Hemisphere, consisting of trees with alternate simple leaves, slender terete branchlets, scaly bark, and heavy, close-grained wood. Seven species have been described, two of which are indigenous to North America. *Ostrya virginiana* (Mill.) K. Koch., the Hop Hornbeam, is widely distributed in the United States east of the Rocky Mountains. The other native species is confined to a restricted area in the Southwest.

Leaves alternate, simple, oblong-lanceolate to oval and obovate, acute or rounded at the apex, rounded at the base, short-petioled. **Flowers** monoecious, expanding before the leaves; staminate flowers in short-stalked or sessile, clustered aments which are preformed the preceding season near the tips of the branchlets, consisting of 3—4 stamens with short, bifurcated filaments terminating in hairy anthers, inserted on a receptacle at the base of a broadly ovate, acute, concave scale; pistillate flowers in erect, lax aments terminating short leafy branchlets, borne at the base of a narrowly ovate, foliaceous, ciliate scale which persists until mid-summer, each flower enclosed in a saccate involucre formed from the union of a bract and two bracteoles; calyx adnate to the ovary; style short, bearing 2 filiform stigmas. **Fruit** a small, ovoid, compressed, acute nutlet enclosed in an enlarged, pale straw-colored, saccate involucre, the cluster resembling the fruit of the hop, hence the name, Hop Hornbeam.

THE HORNBEAMS. Genus *CARPINUS* L.

Carpinus includes about twenty species of small trees or shrubs scattered over the North Temperate Zone from Quebec to Central America in the New World, and through Europe, Asia, China and Japan in the Old World. They are characterized by smooth gray bark, fluted trunks, and prominently ribbed nutlets subtended by a trilobed,

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foliaceous, involucre bract. One species, *C. caroliniana* Walt., is found in the United States.

Leaves alternate, simple, ovate, acute or acuminate, cordate or rounded at the base, petioled; stipules strap-shaped to oblong-obovate. **Flowers** monoecious, vernal; staminate flowers in pendent aments which appear from buds produced the previous season, naked, consisting of several stamens with bifurcated filaments terminated by anthers borne in the axils of broadly ovate, acute, nearly sessile scales; pistillate flowers in slender, few-flowered aments terminal on leafy branchlets of the year, in pairs at the base of an ovate, acute, leafy, deciduous scale, each pair subtended by a bract and two bractlets; calyx adnate to the 2-celled ovary; stigmas 2, subulate. **Fruit** a small, acute, compressed, longitudinal-ribbed nutlet tipped with the calyx-lobes and attached at the base until maturity to a large, foliaceous, 3-lobed, pale green involucre formed by the union of the accrescent bract and bracteoles.

THE BIRCHES. Genus BETULA L.

The genus *Betula* includes about forty species of deciduous trees and shrubs, scattered through the Subarctic and North Temperate Zones in Europe, Asia, and North America. Some are large ornamental trees with white or silvery, laminated, papery bark. Others are reduced to scraggly, nearly resupinate shrubs and are confined to subarctic regions or alpine summits. Nine species reach tree-size in the United States five of which are native to the Northeastern States. European White Birch, *B. pendula* Roth., is grown as an ornamental and has become sparingly naturalized in the Northeast.

Leaves alternate, simple, serrate or dentate, petioled. **Flowers** monoecious, unfolding with or before the leaves, anemophilous; staminate flowers in pendulous, solitary or clustered, sessile aments which are pre-formed the previous season and remain erect and naked on the twigs during the winter, borne in groups of 3 under a peltate bract and two bracteoles, each flower consisting of two 2-parted filaments terminating in anther sacs and accompanied by a calyx of a single sepal; pistillate flowers without perianth, borne in clusters of 3 subtended by a 3-lobed, persistent accrescent scale, the many closely-imbricated scales forming short, oblong or cylindrical, usually short-stalked aments which terminate short, lateral, 2-leaved branches; pistil consisting of a compressed, sessile ovary terminated by 2 spreading, persistent styles which are stigmatic at the apex. **Fruit** a small, laterally winged, compressed nutlet, the nutlets borne in threes in the axils of thin, woody, 3-lobed, imbricated scales which form an erect, inclined or pendent, oblong or oblong-ovoid strobile.

KEY TO THE SPECIES

- | | |
|---|------|
| 1. Leaves with 9—11 pairs of lateral veins; strobiles oblong-ovoid; | Page |
| branches aromatic when broken | 2 |

KEY TO GENERA AND SPECIES

1. Leaves with 5—9 pairs of lateral veins; strobiles cylindrical or oblong-cylindrical; branches not aromatic when broken3
2. Leaves bright green above, thickish; base generally heart-shaped; mature bark dull brownish black, furrowed and broken into large irregular plates**B. lenta** 181
2. Leaves dull green above, membranous; base broadly cuneate or slight heart-shaped; bark on young trunks bright silvery-gray, exfoliating in thin, revolute, clinging scales**B. lutea** 183
3. Leaves triangular to rhombic-ovate4
3. Leaves ovate or oval to deltoid5
4. Leaves very taper-pointed at the apex; strobiles cylindrical, ripening in the autumn**B. populifolia** 185
4. Leaves acute at the apex; strobiles oblong-cylindrical, ripening in May and June**B. nigra** 187
5. Leaves 2—3 inches long, pubescent beneath when young; branchlets non-glandular or sparingly glandular**B. papyrifera** 189
5. Leaves 1—2¾ (usually 2—2¾) inches long, glabrous from the first; branchlets resinous-glandular**B. pendula** 191

THE ALDERS. Genus ALNUS Mill.

This genus includes about thirty species of moisture-loving shrubs and trees, widely scattered in the Northern Hemisphere, in America, extending south to Peru. They are essentially plants of cool climates and frequently form extensive thickets, inhabiting cold swamps, the banks of trout-streams, and the slopes of high mountains. *Alnus rubra* Bong., is a timber tree in northwestern United States. Three species of alder occur in the Northeast, two of which occasionally attaining the stature of small trees.

Buds stalked with with 2—3 subequal scales or sessile with imbricated scales; bud-scales stipular. **Leaves** alternate, simple, usually serrate or dentate and often shallowly lobed, pinnately veined, short-petioled, falling without change of color; secondary veins usually prominent on the under side of the leaf. **Flowers** monoecious, preformed in the autumn and appearing the next spring before the leaves, or autumnal, borne in aments; staminate aments long-cylindrical, paniculate, upright during the winter in the vernal-flowering species and elongating and becoming pendulous in early spring; staminate flowers in 1—3-flowered cymes in the axils of peltate, short-stalked scales, each flower with a 4-parted calyx and 4 (rarely 1—3) stamens; pistillate aments shorter than the staminate, ovoid or oblong, erect, stalked, produced in summer below the staminate inflorescences; bracts of pistillate aments with two adnate bractlets, with two flowers devoid of calyx; pistil consisting of a compressed ovary surmounted by two styles. **Fruit** a minute, compressed, usually narrowly winged nutlet, the nutlets borne in pairs in the axils of woody, 5-lobed or truncate, persistent scales which form an ellipsoid or ovoid strobile; strobiles persisting long after the opening of the closely imbricated scales.

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THE BEECH FAMILY. FAGACEAE

Trees and shrubs with watery juice, slender terete branchlets, alternate stalked stipulate leaves, and monoecious flowers. The *Fagaceae* number about six hundred species, arranged in six genera, and are of wide distribution in the temperate and subtropical regions of both Hemispheres. Five genera are represented in the United States of which one is general in distribution, two are confined to the Eastern States, and the remaining two are found on the Pacific Slope.

Leaves alternate, simple, penniveined; stipules linear, caducous. **Flowers** monoecious, small; staminate flowers in aments or capitate; calyx 4—8-lobed; stamens 4—20, with slender filaments and elongated, 2-celled anthers; pistillate flowers solitary or in few-flowered clusters or spikes, subtended by a scaly, persistent involucre; calyx 4—8-lobed, adnate to the ovary; pistil consisting of a 3—7-celled ovary surmounted by a like number of linear styles. **Fruit** a 1-seeded nut subtended or enveloped by a persistent, accrescent involucre; seed exalbuminous, with fleshy cotyledons.

KEY TO THE GENERA

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|--|---------------------|
| 1. Staminate flowers capitate; nut trigonous | Fagus 412 |
| 1. Staminate flowers in slender aments; nut rounded | 2 |
| 2. Pistillate flowers 2—5 in each involucre becoming a prickly burr in fruit | Castanea 413 |
| 2. Pistillate flowers 1 in each involucre; involucre forming a subtending cup in fruit | Quercus 413 |

THE BEECHES. Genus FAGUS L.

A genus of about nine species characterized by smooth gray bark, slender wiry branchlets, chestnut-brown lanceolate buds, and hard, close-grained wood. The beeches are widely distributed through the temperate regions of the Northern Hemisphere. But one species, *Fagus grandifolia* Ehrh., is found in the United States and this is confined to regions east of the Great Plains.

Leaves alternate, simple, firm, deciduous, strikingly straight-veined, plicate in the bud, short-petioled; stipules linear-lanceolate. **Flowers** monoecious, expanding with or soon after the leaves; staminate flowers in capitate, many-flowered, drooping heads borne on long, 2-bracted peduncles; pedicels short; calyx-tube campanulate, 4—8-lobed, greenish yellow; stamens 8—16, exserted, inserted on the calyx-tube; pistillate flowers in sessile or stalked clusters of 2—4 arising in the axils of the upper leaves, each subtended by numerous awl-shaped bracts the lower of which are bright red and deciduous, the upper united to form a 4-lobed burr; calyx 4- or 5-lobed, villous, adnate to the ovary; pistil consisting of a 3-celled, trigonous ovary surmounted by 3 filiform, recurved styles which are longer than the involucre and stigmatic at the top.

KEY TO GENERA AND SPECIES

Fruit a woody, thick-walled, ovoid burr covered with stout, recurved prickles, opening at maturity to set free the 2 (1—3) ovoid, trigonous, lustrous brown nuts; seed albuminous, oily, edible.

THE CHESTNUTS. Genus *CASTANEA* Mill.

Trees or shrubs with astringent sap, terete twigs, furrowed bark, alternate straight-veined leaves, monoecious flowers appearing after the leaves, and a fruit which is a prickly burr enclosing one or more nuts. *Castanea* is wholly confined to the Northern Hemisphere and is widely distributed through eastern North America, southern Europe, northern Africa, Asia, and Japan. Eight species have been described including the American Chestnut, *C. dentata* (Marsh.) Borkh.

Leaves alternate, simple, deciduous, ovate to oblong-lanceolate, coarsely serrate with secondary veins running into the teeth, short-petioled; stipules linear-lanceolate to ovate, caducous. **Flowers** monoecious, ill-smelling, appearing in midsummer after the leaves; staminate flowers in 3—7-flowered cymes in the axils of minute, ovate bracts, the clusters borne in elongated, interrupted, simple aments which arise from the axils of the inner bud-scales of the upper bud or from the axils of the lower leaves of the year; calyx-tube straw-colored, puberulous, deeply divided into 6 ovate, rounded segments; stamens 10—20, exserted, with filiform filaments and globose or ovoid anthers; pistillate flowers scattered or spicate at the base of the shorter, persistent, androgynous aments from the axils of the upper leaves, sessile, solitary or 2—3 together and surrounded with an involucre of numerous, acute, green bracts, the whole subtended by a bract and 2 bracteoles; calyx urn-shaped, 6-lobed, adnate to the ovary; 6 staminodia present; pistil consisting of a 6-celled ovary surmounted by 6 linear, spreading, white styles which are hairy below and bear terminal stigmas. **Fruit** a densely-spiny burr, maturing in the autumn and dehiscing by 2—4 valves to expose an inner surface clothed with lustrous pubescence and 1—3 ovate, acute, chestnut-brown nuts which are pubescent toward the apex and marked at the base by a large, conspicuous, rounded scar; seed usually solitary, exalbuminous, sweet and edible; cotyledons fleshy.

THE OAKS. Genus *QUERCUS* L.

This genus comprises more than two hundred and seventy-five species of trees and shrubs widely spread in various habitats over the temperate regions of the Northern Hemisphere and the high mountains of the tropics. In the New World they range from Canada southward through Mexico and Central America to the mountains of Columbia, and in the Old World through Europe and Asia to the Indian Archipelago, the Philippines and Japan. Eighty-odd species occur within the boundaries of the United States, over fifty of which are important in forestry. Numbered among these are some of our best timber trees,

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producing hard and strong woods excellent for structural purposes, furniture, interior finish, tight cooperage, etc. A number of natural hybrids have been described.

Leaves alternate, simple, deciduous or persistent, entire, pinnately lobed or variously toothed, often very variable on the same tree; stipules scarious, caducous or occasionally persistent. **Flowers** monoecious, appearing with or before the leaves; staminate flowers in clustered, drooping, interrupted aments arising from the axils of the leaves of the previous year, the axils of the inner scales of the terminal bud, or of the leaves of the year; calyx yellowish green, campanulate, 4—7-lobed or divided; stamens 4—12, with filiform exserted filaments and yellow anthers; pistillate flowers solitary or in few-flowered spikes from the axils of leaves of the year, each flower subtended by a bract and two bracteoles; calyx urn-shaped, adnate to the ovary, with short-campanulate, 6-lobed limb; pistil consisting of an incompletely 3- or rarely 4—5-celled ovary which is nearly enclosed in an accrescent involucre of imbricated scales, surmounted by 3 short or elongated styles. **Fruit** an ovoid-oblong or subglobose, 1-seeded nut (acorn), maturing in 1—2 years, subtended at the base and more or less enveloped in a woody cup (involucre) of imbricated, partly united scales; cotyledons fleshy, plano-convex and entire.

KEY TO THE SPECIES

- | | Page |
|---|---|
| 1. Acorns maturing at the end of the first season; shell of acorn glabrous on the inner surface; leaves and their lobes obtuse (rarely with teeth and then never bristle-tipped); bark generally pale, often scaly (White Oaks) | 2 |
| 1. Acorns maturing at the end of the second season; shell of acorn tomentose on the inner surface; leaves with bristle-tipped lobes or entire or nearly entire; bark dark, furrowed (Red Oaks)..... | 11 |
| 2. Leaf-margin distinctly lobed, the sinuses extending part way or nearly to the midrib; lobes entire or variously indented..... | 3 |
| 2. Leaf-margin serrate, dentate, or otherwise shallowly indented.. | 6 |
| 3. Mature leaves pubescent or tomentose beneath | 4 |
| 3. Mature leaves glabrous beneath | Q. alba var. latiloba 199 |
| 4. Mature leaves glabrous or pilose above, white-pubescent or tomentose below; terminal leaf-lobe much the larger | 5 |
| 4. Mature leaves with scattered stellate hairs above, rusty-pubescent or tomentose beneath; upper leaf-lobes usually cruciate | Q. stellata 201 |
| 5. Leaves somewhat downy beneath; fruit sessile or short-stalked; acorn enclosed one-half or more of its length in the cup..... | Q. macrocarpa 203 |
| 5. Leaves silvery-white or tawny below; fruit long-stalked; acorn enclosed about one-third of its length in the cup | Q. bicolor 205 |
| 6. Leaves prevailingly lanceolate or oblong-lanceolate to narrowly ovate or narrowly obovate | 7 |
| 6. Leaves prevailingly ovate to oval, elliptical and broadly obovate | 9 |

KEY TO GENERA AND SPECIES

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7. Teeth acute8
7. Teeth obtuse**Q. montana** 207
8. Leaves 4—7 inches long, coarsely toothed with 8—13 pairs of acute, mucronate, often incurved teeth; petioles $\frac{3}{4}$ —1½ inches long**Q. muhlenbergii** 211
8. Leaves 2—6 inches long, coarsely toothed with 3—7 pairs of acute or obtusish teeth, or undulate-dentate; petioles $\frac{1}{2}$ —¾ths of an inch long**Q. prinoides** 209
9. Leaves coarsely sinuate- or undulate-crenate10
9. Leaves coarsely serrate or dentate**Q. muhlenbergii** 211
10. Leaves undulate-crenate**Q. montana** 207
10. Leaves sinuate-crenate**Q. macrocarpa** 203
11. Leaves distinctly lobed; lobes entire or variously indented.....12
11. Leaves entire or the margin slightly undulate**Q. phellos** 213
12. Leaves pinnatifid or pinnately lobed13
12. Leaves 3—5 lobed at the summit (broadly obovate)**Q. marilandica** 215
13. Leaves green on both surfaces, glabrous or somewhat pubescent below14
13. Leaves whitish or grayish tomentose below**Q. ilicifolia** 217
14. Longest lobes of the leaf about equaling the breadth of the broadish middle portion of the leaf15
14. Longest lobes of the leaf 2—6 times as long as the breadth of the narrow middle portion of the leaf16
15. Cup turbinate**Q. borealis** 221
15. Cup saucer-shaped**Q. borealis** var. **maxima** 219
16. Leaves coriaceous, very lustrous above; petioles 2—6 inches long**Q. velutina** 223
16. Leaves membranous, somewhat lustrous above; petioles $\frac{1}{2}$ —2½ inches long17
17. Leaves broadly oval to obovate; leaf-bases prevailinglly cuneate; cup of acorn saucer-shaped; acorn hemispherical, about $\frac{1}{2}$ of an inch long**Q. palustris** 225
17. Leaves oblong-obovate to elliptic; leaf-bases prevailinglly obtuse or truncate; cup turbinate; acorn ovoid, $\frac{1}{2}$ —1 inch long.....**Q. coccinea** 227

ELM FAMILY. ULMACEAE

Trees or shrubs with watery juice, terete branchlets, alternate simple leaves, perfect or polygamous flowers, and a fruit which is a samara, nut, or drupe. This Family includes about fifteen genera and some one hundred and fifty species, widely distributed throughout both Hemispheres except the polar regions. Five genera are represented within the boundaries of the United States, four by arborescent forms in the eastern and southern states.

Leaves alternate, deciduous, simple, serrate, penniveined, petioled, inequilateral at the base; stipules usually fugacious. **Flowers** small, perfect, monoecious or polygamous, clustered or the pistillate solitary; calyx-tube regular, 4—9-lobed or parted; petals lacking; stamens 4—6,

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exserted, with straight filaments and longitudinally dehiscent anthers; pistil consisting of a 1-celled, 1-ovuled ovary surmounted by 2 styles and stigmas. **Fruit** a samara, drupe or nutlet.

KEY TO THE GENERA

| | Page |
|---|-------------------|
| 1. Flowers perfect; fruit a samara | Ulmus 416 |
| 1. Flowers polygamo-monoecious; fruit a drupe | Celtis 417 |

THE ELMS. Genus ULMUS L.

Trees or shrubs with scaly bark, alternate serrate inequilateral leaves, perfect flowers, samaroid fruit, and heavy tough wood. Some eighteen species are known which are widely distributed through the subarctic and temperate regions of the Northern Hemisphere, western North America excepted. Six native species occur in the United States, all confined to regions east of the Rocky Mountains, three of which extend into the Northeastern States. Three foreign species, introduced as ornamentals, have become naturalized.

Leaves alternate, deciduous, simple, simply or doubly serrate, with straight secondary veins; stipules scarious, caducous. **Bud-scales** several. **Flowers** on twigs of the previous season, vernal and appearing before the leaves or autumnal and arising from the axils of the leaves of the season, perfect, borne on bibracteolate pedicels in fascicles or racemes; calyx-tube campanulate, membranaceous, 4—9-lobed; stamens 5—6, exserted, with slender filaments and oblong anthers; pistil consisting of a sessile or stalked, compressed, 1-celled, 1-ovuled ovary surmounted by 2 divergent styles stigmatic on their inner faces. **Fruit** a flat, ovate or oblong, often oblique, sessile or stalked, 1-seeded samara subtended at the base by the remnants of the calyx and tipped with the remnants of the styles; seed compressed, exalbuminous, in our forms germinating in early summer.

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| 1. Leaves doubly serrate, inequilateral at the base | 2 |
| 1. Leaves simply or nearly simply serrate, nearly equilateral at the base | U. parvifolia 229 |
| 2. Flowers on slender pedicels, drooping | 3 |
| 2. Flowers short-pedicelled, not pendulous, in dense clusters | 4 |
| 3. Flowers in racemose clusters; leaves smooth and somewhat lustrous above; faces of samaras pubescent; winter-buds prickly to the touch; branchlets often with corky wings | U. thomasi 231 |
| 3. Flowers in short-stalked fascicles; leaves slightly scabrous above; faces of samaras smooth; winter-buds acute but not prickly to the touch; branchlets without corky wings | U. americana 233 |
| 4. Leaves ciliate; faces of samaras pubescent; winter-buds covered with rusty hairs | U. fulva 235 |

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| 4. Leaves not ciliate; faces of samaras not pubescent; winter-buds pale-pubescent or glabrous | 5 |
| 5. Petioles about $\frac{1}{8}$ of an inch long; samaras with the seed in center, about $\frac{1}{4}$ ths of an inch broad | U. glabra 237 |
| 5. Petioles $\frac{1}{4}$ — $\frac{1}{2}$ of an inch long; samaras with the seed near the apex, $\frac{1}{4}$ ths of an inch broad or less | U. procera 239 |

THE HACKBERRIES. Genus *CELTIS* L.

The genus *Celtis* includes some seventy species of trees and shrubs, widely scattered throughout the temperate and tropical regions of the world. They resemble the elms in many respects but differ in having polygamous flowers and drupaceous fruit. The American forms are very variable in the shape of the leaves and the number of species is as yet not definitely fixed. At least one aborescent form, *C. occidentalis* L., and a variety of this occur within the range of this text.

Leaves alternate, deciduous, simple, serrate, prominently 3—5-nerved; stipules membranous, caducous. **Flowers** small, axillary, polygamo-monoecious, pedicellate, appearing with the leaves on branchlets of the year; staminate flowers fascicled toward the base of the growth of the season, the pistillate solitary or 2—3 together in the upper leaf-axils; calyx deeply 4—5-lobed or -parted, greenish yellow, deciduous; stamens 4—5, with incurved, subulate filaments which straighten abruptly at anthesis in the staminate flowers and catapult the pollen, but remain curved and shorter in the perfect flowers; pistil consisting of an ovoid, sessile ovary crowned by the 2 reflexed styles which are stigmatic on the inner faces. **Fruit** an ovoid or globose drupe with thick firm skin, thin flesh, and thick-walled, bony, rugose or smooth nutlet.

MULBERRY FAMILY. MORACEAE

A large Family of deciduous or evergreen trees, shrubs, and herbs, numbering about one thousand species distributed in fifty-five genera, scattered over the tropical and temperate regions of the World, chiefly the former. Three genera are represented by indigenous arborescent forms in North America while a fourth includes the naturalized Paper Mulberry, *Broussonetia papyrifera* (L.) Vent.

Sap generally milky. **Buds** scaly or naked. **Leaves** alternate, simple, petioled; stipules enclosing the leaf in the bud. **Flowers** monoecious or dioecious, small, arising from the axils of caducous bud-scales or from the lower leaves of the season, arranged in ament-like spikes or heads which are borne without or within a receptacle; calyx of staminate flower 3—4-lobed or -parted; stamens 1—4, inserted on the calyx; calyx of pistillate flower deeply 3—5-lobed; pistil consisting of a 1—2-celled ovary surmounted by 1—2 styles and stigmas. **Fruit** drupaceous, enclosed in the fleshy calyx, multiple.

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| 1. Staminate and pistillate flowers in ament-like spikes | Morus 418 |

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| 1. Staminate flowers racemose; pistillate flowers capitate | 2 |
| 2. Leaves crenate-serrate of variously lobed; fruit about $\frac{3}{4}$ of an inch in diameter; twigs unarmed | Broussonetia 418 |
| 2. Leaves entire; fruit 3—5 inches in diameter; twigs armed..... | Maclura 419 |

THE MULBERRIES. Genus MORUS L.

Morus is represented by about twelve species of trees or shrubs with milky sap, scattered over the subtropical and temperate regions of the Northern Hemisphere. Two species are found in the United States, the Red Mulberry with a wide distribution east of the Great Plains, and a southwestern form. The White Mulberry, a native of northern China and Japan, was introduced in an attempt to establish the silk industry and has become widely naturalized in the Eastern States.

Leaves alternate, deciduous, simple, entire, serrate or variously lobed, 3-nerved at the base; stipules enclosing the leaf in the bud, lanceolate, caducous. **Flowers** monoecious or dioecious, the staminate and pistillate on different branches of the same plant or on different plants, vernal, in pedunculate clusters from the axils of caducous bud-scales or the lower leaves of the year; staminate flowers in elongated, cylindrical spikes; calyx with 4 rounded lobes; stamens 4, inserted opposite the lobes and inflexed in the bud, straightening elastically at anthesis and becoming exserted; rudimentary ovary present; pistillate flowers sessile, in short compact spikes; calyx 4-parted with thickened, ovate or obovate, valvate lobes (outer pair longest) enveloping the flattened, ovoid ovary; styles 2, white, spreading. **Fruit** a multiple, fleshy syncarp resembling a blackberry, consisting of many drupelets, each enclosed in the succulent, thickened, colored calyx and crowned with the style-remnants; seed pendulous, albuminous.

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| 1. Leaves glabrous beneath or sparingly pubescent on the veins; fruit white, pinkish, or purplish violet | M. alba 243 |
| 1. Leaves soft-pubescent beneath; fruit dark purple | M. rubra 245 |

THE PAPER MULBERRY. Genus BROUSSONETIA Vent.

Broussonetia includes three or four species of trees or shrubs with milky juice, alternate or opposite, entire or lobed leaves, capitate clusters of pistillate flowers, and fibrous inner bark. One species, *B. papyrifera* (L.) Vent., has become widely naturalized in the temperate portions of eastern United States.

Leaves alternate, deciduous, simple, entire, serrate or variously 1—5-lobed, 3-nerved at the base, long-petioled. **Flowers** dioecious, vernal, bracteate, the staminate in oblong, cylindrical, nodding, ament-like spikes, the pistillate in capitate clusters; staminate flowers with 4-parted calyx; stamens 4, inserted opposite the lobes, exserted at an-

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thesis; rudimentary ovary present; pistillate flowers with a tubular calyx, stalked ovary, and laterally attached, filiform stigma. **Fruit** a globular head consisting of many red drupes, each subtended by the persistent perianth and bract, and borne on a fleshy gynophore.

THE OSAGE ORANGE. Genus *MACLURA* Nutt.

A genus endemic to the United States and consisting of a single species, *Maclura pomifera* (Raf.) Schn., originally confined to a restricted area in southern Missouri, Oklahoma and northeastern Texas but now widely naturalized in eastern United States. A medium-sized tree with rounded crown, spinescent twigs, milky juice, and deeply furrowed, orange-brown bark.

Leaves alternate, deciduous, simple, ovate to oblong-lanceolate, rounded or subcordate at the base, entire, at maturity dark green and lustrous above, duller and conspicuously reticulate-veined beneath, turning bright yellow in the autumn; petioles long, terete; stipules small, caducous. **Branchlets** with short, lateral spurs or armed with sharp axillary spines. **Flowers** dioecious, appearing after the leaves; staminate flowers in long-stalked, subglobose heads from the axils of crowded leaves on short lateral spurs, slender-pedicelled; calyx 4-lobed; stamens 4, opposite the lobes of the calyx, inflexed in the bud but straightening elastically at anthesis and becoming exserted; pistillate flowers in dense, sessile or short-stalked heads arising in the axils of the leaves of the season; calyx ovate, divided to the base into thick, oblong, concave lobes which closely invest the ovary, the outer pair the larger; pistil consisting of an ovate, compressed, green, 1-ovuled ovary surmounted by an elongate, filiform style. **Fruit** a globose, yellowish green, mammillate aggregate 4—5 inches in diameter, consisting of many, oblong, compressed drupelets and the thickened, much elongated perianths, the whole saturated with milky juice; seeds oblong, compressed, light chestnut-brown, exalbuminous, embedded in the milky pulp.

SUBCLASS 2. POLYPETALAE

Dicotyledons in which both calyx and corolla are present (or without corolla in *Liquidambar*, certain species of *Acer*, etc.), the corolla consisting of separate petals.

MAGNOLIA FAMILY. MAGNOLIACEAE

A Family of ten genera and about eighty species, widely distributed in the temperate and subtropical regions of America and Asia. They are trees or shrubs with watery juice, bitter aromatic bark, alternate leaves, showy flowers, and thick rootlets. Four genera are represented in North America, two by arborescent forms in eastern United States.

Bud-scales stipular, enclosing the leaves in the bud. **Leaves** alternate, penniveined, petioled, conduplicate in the bud. **Flowers** large, showy,

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terminal, perfect, pedunculate, enclosed in the bud in a caducous, stipular sheath; sepals and petals generally of the same color, imbricated in the bud, hypogynous, deciduous; stamens numerous (rarely 4), spirally arranged on the elongated receptacle; pistils numerous, similarly arranged or rarely in a whorl, inserted above the stamens. **Fruit** an aggregate head of 1—2-seeded follicles or samaras forming a naked, cone-like structure, the axis marked below by the scars of the deciduous stamens and perianth-lobes.

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| 1. Leaves entire or auriculate at the base; anthers introrse; carpels fleshy at maturity, dehiscent, persistent | Magnolia 420 |
| 1. Leaves 4—6 lobed; anthers extrose; carpels dry at maturity, indehiscent, deciduous | Liriodendron 420 |

THE MAGNOLIAS. Genus MAGNOLIA L.

Trees or shrubs with smooth or scaly bark, branchlets encircled by stipular scars, stipular membranous bud-scales, and showy terminal flowers. The genus includes about thirty-five species, natives of eastern North and Central America, and eastern Asia and the Himalaya. Eight species are indigenous to the Eastern States, two of which occur in the Northeast.

Leaves alternate, deciduous or persistent, simple, entire or auriculate at the base, often minutely punctate. **Flowers** perfect, hypogynous, terminal, showy, appearing before or after the leaves; sepals 3, spreading or reflexed; petals 6—12, concave, erect or spreading, arranged in series of 3; stamens numerous, with short filaments and linear anthers, early deciduous; pistils numerous, spiralled above the stamens on the receptacle, consisting of a 1-celled, 2-ovuled, sessile ovary and a short recurved style. **Fruit** an aggregate, scarlet or rusty-brown cone consisting of coalesced, drupaceous, persistent follicles which dehisce at maturity on the dorsal suture; seeds scarlet, drupe-like, compressed, albuminous, suspended from the follicles by a thin cord of uncoiled spiral vessels.

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| 1. Leaves elliptic to oblong and oblong-lanceolate, thick, sub-persistent, 3—6 inches long | M. virginiana 251 |
| 1. Leaves broadly elliptic to ovate and oblong-ovate, thin, deciduous, 4—10 inches long | M. acuminata 253 |

THE TULIP TREES. Genus LIRIODENDRON L.

Trees with deeply furrowed brown bark, branchlets encircled by stipular scars, stipular membranous bud-scales, lobed truncate leaves, and cone-like fruits consisting of samaroids. The genus includes but

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two species, one widely distributed in the eastern United States, the other in central China.

Leaves alternate, deciduous, simple, truncate, heart-shaped or somewhat cuneate at the base, truncate or with a broad, shallow sinus at the apex, sinuately 4- (rarely 6-) lobed. **Flowers** perfect, hypogynous, terminal, showy, appearing after the leaves; sepals 3, greenish white, concave, erect or spreading, early deciduous; petals 6 in 2 series, erect, early deciduous; stamens numerous, with filiform filaments and linear, 2-celled anthers; pistils numerous, spiralled above the stamens on the receptacle and imbricated in a spindle-shaped column, with winged style and small stigma. **Fruit** a narrow, erect, pale brown cone consisting of many flattened, samara-like, indehiscent, 4-ribbed carpels which fall away from the axis at maturity; seeds 1—2, suspended, albuminous.

CUSTARD-APPLE FAMILY. ANNONACEAE

A large tropical Family widely distributed in the tropical and subtropical regions of both the New and Old World, consisting of over six hundred species grouped in more than seventy genera. But two genera are represented in the United States, one in the Eastern States, the other confined to southern Florida and the West Indies.

Sap watery. **Branchlets** terete, with conspicuous leaf-scars. **Leaves** alternate, entire, penniveined, estipulate, petioled. **Flowers** perfect, solitary, axillary or opposite the leaves; sepals 3, valvate in the bud; petals 6, in two series; stamens numerous on the elevated, rounded receptacle, with short distinct filaments and 2-celled anthers which are prolonged above into a broad, fleshy, truncate connective; pistils few, inserted on the summit of the receptacle; ovary 1-celled, 1-many ovuled. **Fruit** baccate or compound, generally fleshy, consisting of the ripened pericarp of one or several pistils; seeds inclosed in an aril, large, smooth, brown and lustrous, with ruminant albumen.

THE PAWPAWS. Genus ASIMINA Adans.

A genus of eight species including small trees or shrubs, confined to eastern North America. One species, *Asimina triloba* Dun., occasionally reaches the stature of a small tree and extends as far north as western New Jersey and New York, and to the northern shores of Lake Ontario. The remaining forms are low shrubs of the South Atlantic and Gulf States.

Twigs ill-scented when bruised. **Buds** minute, cinero-pubescent. **Leaves** membranaceous, entire, petioled, deciduous. **Flowers** mostly from the axils of the leaves of the previous season, nodding, pedunculate, purplish, ill-smelling; sepals green, ovate, concave, smaller than the petals, early deciduous; petals 6, ovate or obovate-oblong, reticulate-veined, accrescent, the 3 exterior alternate with the sepals and spreading, the inner series erect and much smaller; stamens numerous, linear-cuneate, densely packed on the receptacle; anther cells separate on the fleshy

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connective; pistils few on the summit of the receptacle, projecting above the stamens; ovary 1-celled; style oblong, slightly curved, stigmatic on the margin; ovules 4—20, horizontal, 2-ranked on the ventral suture. **Fruit** an oval or oblong, smooth berry; seeds ovate, compressed, marked at the base with a large hilum.

LAUREL FAMILY. LAURACEAE

A large, chiefly tropical Family consisting of aromatic trees and shrubs grouped in about forty-five genera and numbering about one thousand species, widely distributed throughout the warmer parts of the World. Seven genera are represented in North America, five of which are arborescent. One species of *Sassafras* occurs in the Northeast.

Leaves alternate or rarely opposite, rather thick, pellucid-punctate, estipulate. **Flowers** small, regular, yellowish green, perfect, unisexual or polygamous, generally fragrant; calyx 6-lobed, the lobes in 2 series, imbricated in the bud; corolla lacking; stamens 9 or 12, inserted at the base of the calyx in 3 or 4 sets of 3, distinct, the inner set sterile; anthers 4-celled, superposed in pairs, opening by uplifted lids; ovary 1-celled, 1-ovuled; stigma discoid or capitate. **Fruit** a 1-seeded berry or drupe; seed with erect embryo, the cotyledons fleshy.

THE SASSAFRASES. Genus SASSAFRAS Nees.

Aromatic trees with deeply furrowed bark, smooth green pithy mucilaginous twigs, and entire or lobed, alternate leaves. Two species have been described, one a native of the temperate portion of eastern North America, the other of Central China.

Leaves alternate, membranaceous, deciduous, ovate or obovate, entire and acute or 1—3-lobed at the apex with broadly ovate, oblique lobes separated by deep broad sinuses, cuneate at the base, conspicuously reticulate- and arcuate-veined, at maturity dark green, glabrous and impressed-veined above, paler beneath. **Flowers** vernal, appearing with the leaves, usually dioecious, borne on slender pedicels in lax, pilose, umbellate, few-flowered racemes in the axils of accrescent, obovate bud-scales; calyx yellowish green, divided nearly to the base into 6 narrowly obovate, subequal, spreading lobes; stamens 9, inserted in 3 series on the thickened margin of the calyx-tube; filaments elongated, compressed, light yellow, those of the inner series equipped with two orange-colored, stalked glands; anthers oblong, orange-colored, those of the fertile flowers generally reduced to staminodia; pistil consisting of an ovoid, green, glabrous ovary terminated by a long style and capitate stigma. **Fruit** a globose-oblong, dark blue, lustrous berry, borne upright in the red, accrescent, obscurely-lobed calyx and enlarged end of the pedicel; flesh thin; seeds brown, smooth and pointed.

WITCH HAZEL FAMILY... HAMAMELIDACEAE

Deciduous or evergreen trees or shrubs with watery juice, slender terete branchlets, naked or scaly buds, alternate leaves, and fibrous roots. About twenty genera and fifty species are included in this family, natives of eastern North America, southwestern, southern, and eastern Asia, the Malay Archipelago, Madagascar, and South Africa. Three genera are represented in North America, two by arborescent forms.

Leaves alternate, simple, stipulate, petioled, deciduous. **Flowers** perfect or unisexual; calyx 4-parted, the tube adherent to the ovary, or none; petals 4 or none; stamens 4—8, or indefinite, with 2-celled, introrse anthers; pistil consisting of a 2-celled ovary inserted in the bottom of the receptacle, crowned with 2 subulate styles stigmatic on the inner face. **Fruit** a woody, 2-beaked capsule, dehiscent at the summit; seeds 1 or several, albuminous, with straight embryo.

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| 1. Buds with scales; leaves palmately veined; flowers in heads, usually unisexual; capsules consolidated by their bases into a globose head; seed with a terminal wing | Liquidambar 423 |
| 1. Buds naked; leaves penniveined; flowers not in heads, usually perfect; capsules not consolidated into a head; seed without a wing | Hamamelis 424 |

THE SWEET GUMS. Genus LIQUIDAMBAR L.

Large timber trees with balsamic juices, scaly bark, terete and often winged pithy branchlets, star-shaped leaves, and fibrous roots. Four species are included in the genus, distributed in North and Central America, and in western and eastern Asia. One species is a timber tree of eastern United States.

Leaves alternate, deciduous, simple, nearly orbicular, serrate, deeply palmately 5—7-lobed, borne on long petioles; stipules lanceolate, caducous. **Flowers** monoecious (or rarely perfect), the staminate in terminal, racemose, subglobose, capitate clusters, each subtended by 4 caducous bracts, the pistillate in solitary, long-stalked, globular heads from the axils of the upper leaves; stamens numerous, interspersed with minute scales, with oblong anthers and filiform filaments; pistillate flowers surrounded by long-awned scales; calyx obconic, short-limbed, bearing 4 stamens or staminodia at the summit; pistil consisting of a partly inferior ovary terminated by two elongated, subulate, recurving styles. **Fruit** a globose, spiny, woody head consisting of many united capsules, each tipped with the 2 hardened, incurved, beak-like, elongated styles and dehiscing by two valves at the summit; seeds 1—2, compressed, angulate, winged; sterile seeds numerous, much smaller, resembling sawdust.

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THE WITCH HAZELS. HAMAMELIS L.

Deciduous shrubs or small trees with stellate pubescence, naked buds, slender terete wide-spreading branches, simple inequilateral short-petioled leaves, flowers which open from late autumn to early spring, and capsular fruit. Six species are recognized, confined to North America and eastern Asia.

Buds naked, stalked. **Leaves** alternate, deciduous, simple, broad-ovate or nearly obovate to broad-obovate, sinuate-dentate or shallowly lobed, inequilateral at the base, short-petioled; stipules rather large, caducous. **Flowers** perfect, in short-pedunculate, axillary, few-flowered clusters; calyx 4-parted, with spreading, ovate, obtuse lobes, tomentose without; petals 4, long-linear, crumpled in the bud, yellow; stamens 4, alternating with scale-like staminodes with short filaments; styles distinct, short. **Fruit** a 2-valved capsule with the calyx-limb reaching about to the middle; seeds 2, black, lustrous, oblong, forcibly ejected at maturity.

PLANE-TREE FAMILY. PLATANACEAE

A monotypic Family consisting of trees with watery juice, zigzag branches, subpetiolar buds, alternate stipulate leaves, and bark which exfoliates in large irregular scales from the trunk and larger branches. The sole genus consists of six or seven species and is confined to North and Central America, eastern Europe, and southwestern Asia. Three species are found in the United States, one widely distributed in the Eastern States, a second on the Pacific Coast, and a third in the Southwest. \times *Platanus acerifolia* Willd., from the Old World, supposedly a hybrid between *P. occidentalis* L. and *P. orientalis* L., is widely grown in the United States as a street and shade tree under the name of London Plane.

Leaves alternate, simple, broadly ovate, cordate, cuneate, or truncate at the base, palmately 3–7-lobed and veined, the lobes entire, dentate, or coarsely sinuate-toothed; petioles long, abruptly enlarged and enclosing the buds at the base; stipules large, foliaceous and sheathing the branchlet on sterile shoots, thin, scarious, and caducous on flowering shoots; when young the branchlets, leaf-blades, petioles, and stipules are covered with stellate hairs. **Flowers** monoecious, minute, appearing with the unfolding of the leaves in unisexual, pedunculate, globose heads; staminate head dark red, axillary; sepals 3–6, scale-like, slightly united at the base; petals 3–6, cuneiform, about twice as long as the sepals; stamens 3–6, opposite the sepals, with short filaments and elongate, clavate anthers crowned with a pilose, truncate connective; pistillate heads green tinged with red, solitary and terminal or in terminal spicate clusters, the lateral heads then embracing the peduncle at maturity; sepals 3–6, rounded; petals 3–6, acute, longer than the sepals; staminodia present; pistils 3–6, superior, subtended at the base by per-

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sistent, straight hairs, with long curved styles stigmatic on the ventral side. **Fruit** a subglobose head, consisting of many clavate, crustaceous, 1-seeded achenes tipped with the persistent styles and subtended at the base with bristly hairs; seed oblong, albuminous.

THE PLANE TREES. Genus PLATANUS L.

For distribution and characters of the genus, see description of the Family.

ROSE FAMILY. ROSACEAE

Deciduous or evergreen trees, shrubs and herbs, often thorny, numbering upwards to two thousand species, grouped in about one hundred genera. Six tribes are recognized, distinguished chiefly by fruit characters which are accorded family rank by some authors. Rosaceous plants are widely distributed in all parts of the World and include many of our important fruit trees such as the Apple and the Pear, the Strawberry, the Raspberry, etc. Eleven genera are represented by arborescent species within the United States.

Sap watery. **Branchlets** terete. **Buds** scaly. **Leaves** alternate or rarely opposite, simple or compound, deciduous or persistent, stipulate. **Flowers** perfect, generally showy; calyx-tube 5-lobed; petals 5 and separate, or wanting; stamens numerous, distinct, inserted with the petals on a disk lining the calyx-tube; anthers small, 2-celled, longitudinally dehiscent; pistils 1-many, distinct or united and combined with the calyx-tube; ovules 1—2 in each cell. **Fruit** various.

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| 1. Ovary inferior, 1—5 celled, adnate to the enlarged calyx-tube (or receptacle); fruit a pome | 2 |
| 1. Ovary superior, 1-celled; fruit a drupe | Prunus 426 |
| 2. Mature carpals papery or soft-cartilaginous at maturity..... | 3 |
| 2. Mature carpels hard and bony at maturity, forming 1-seeded nutlets | Crataegus 427 |
| 3. Leaves simple; flowers in racemes or umbel-like racemes | 4 |
| 3. Leaves compound (in the species in this text); flowers in terminal leafy compound cymes | Sorbus 427 |
| 4. Ovary 2—5-celled; styles as many as the cells of the ovary..... | 5 |
| 4. Ovary incompletely 6—10-celled; styles half as many as the cells of the ovary | Amelanchier 428 |
| 5. Styles connate at the base; fruit usually apple-shaped, its flesh without or with few grit cells | Malus 429 |
| 5. Styles free; fruit usually pear-shaped, its flesh with numerous grit cells | Pyrus 429 |

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THE PLUMS AND CHERRIES. Genus PRUNUS L.

Trees or shrubs with bitter astringent properties, slender branchlets, scaly buds, alternate simple leaves, showy flowers, and drupaceous usually edible fruits. Many contain hydrocyanic acid in the leaves and seeds to which their peculiar odor is traceable; some exude a gum from the bark when wounded. The species of *Prunus* number about two hundred and are widely distributed throughout the temperate and tropical regions of the Northern Hemisphere, a few occurring in the Andes of South America. Some thirty species are found in the United States, twenty-two of which are arborescent. In addition a number of species from the Old World have become naturalized.

Leaves alternate, deciduous or persistent, simple, serrate or entire, petioled, the petioles often glandular; stipules small, caducous. **Winter buds** scaly, the inner scales accrescent. **Flowers** perfect, regular, showy, borne in axillary umbels, corymbs, or in terminal or axillary racemes; calyx-tube inferior, 5-lobed, the lobes imbricated in the bud; petals 5, white, spreading, inserted with the numerous stamens on the calyx-tube; filaments filiform, free, bearing oval, 2-celled anthers; pistil solitary, consisting of a simple, 1-celled ovary terminated by an elongated style and capitate stigma. **Fruit** a 1-seeded drupe; flesh thick and pulpy or dry and thin; pit bony, compressed, smooth, rugose or pitted; seed solitary, pale brown, exalbuminous; cotyledons fleshy.

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| 1. Ovary glabrous; pit smooth or shallowly sculptured | 2 |
| 1. Ovary velvety-tomentose | P. persica 267 |
| 2. Flowers in racemes terminating leafy branches | 3 |
| 2. Flowers umbellate or corymbose | 4 |
| 3. Leaves oblong, rather thick, crenate-serrulate with incurved teeth | P. serotina 269 |
| 3. Leaves chiefly obovate, thin, sharply serrate, the teeth somewhat spreading | P. virginiana 271 |
| 4. Flowers in axillary umbels appearing before or with the leaves..... | 5 |
| 4. Flowers in terminal corymbs appearing after the leaves..... | P. mahaleb 273 |
| 5. Leaves conduplicate in the bud; fruit without ventral groove; stone globose or subglobose | 6 |
| 5. Leaves convolute in the bud; fruit usually with a ventral groove; stone compressed | 8 |
| 6. Leaves ovate, oval or obovate; petals $\frac{1}{2}$ — $\frac{3}{4}$ of an inch long | 7 |
| 6. Leaves oblong-lanceolate; petals less than $\frac{1}{2}$ of an inch long | P. pennsylvanica 275 |
| 7. Leaves membranous, pubescent beneath at least on the veins; fruit generally sweet; inner accrescent scales of flower-buds ligulate and spreading at blossom time | P. avium 277 |

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| 7. Leaves semi-coriaceous, glabrous; fruit sour; inner accrescent scales of flower-buds not ligulate, ascending at blossom time..... | P. cerasus 279 |
| 8. Leaves ovate to obovate; fruit more than ½ of an inch in diameter | 9 |
| 8. Leaves oblanceolate to narrowly obovate; fruit ½ of an inch or less in diameter | P. insititia 281 |
| 9. Umbels several flowered | 10 |
| 9. Umbels 1—2 flowered | P. domestica 283 |
| 10. Leaves crenulate-serrate; calyx-lobes glandular-serrate | P. nigra 285 |
| 10. Leaves sharply-serrate; calyx-lobes entire | P. americana 287 |

THE THORN-APPLES OR HAWS. Genus CRATAEGUS L.

Low, wide-spreading trees or shrubs with usually dark or gray scaly bark, rigid terete more or less zigzag branches often armed with stiff sharp thorns, alternate simple leaves, showy flowers, and pomaceous fruit. The genus attains its best development in eastern North America where about eight hundred species have been described; approximately ninety species are known in the Old World. In New York State alone over two hundred species are said to occur although the validity of some of these is open to question. While much work has been done on this genus, it is still imperfectly known, especially in North America.*

Leaves alternate, deciduous, simple, serrate and sometimes variously lobed, petioled; stipules caducous or foliaceous on vigorous shoots. **Flowers** perfect, regular, showy, borne in simple or compound corymbs terminating short, leafy branchlets, the lowermost pedicels of a cluster often from the axils of the uppermost leaves; calyx-tube obconic, adnate to the ovary, the 5 lobes acute, reflexed, and generally persistent; petals 5, white or pinkish, spreading, inserted on the throat of the calyx, early deciduous; stamens variable in the same species, normally 5 and alternate with the petals but varying in multiples of 5 up to 25; filaments subulate, incurved, often persistent on the fruit; anthers pale yellow to white or from pink to dark rose and purple; pistil consisting of a 1—5-celled, inferior ovary crowned with a like number of styles and stigmas; ovules 1—2 in each cell. **Fruit** a small, short-globose, oblong or pyriform pome, varying in color chiefly from red to yellow, containing 1—5 bony nutlets, each with a single upright seed.

THE MOUNTAIN ASHES. Genus SORBUS L.

Trees or shrubs with smooth aromatic bark, stout branchlets, alternate odd-pinnate or simple leaves, flowers in showy flat compound cymes, and numerous small pomaceous, red or orange-red fruits. About

*N. B. Since it is not feasible in this text to include descriptions of all the species of *Crataegus* known to occur in the Northeastern States, the Key to Species is omitted for this genus. Descriptions of two common native species, and one widely naturalized species, may be found on pages 288 to 293 inclusive.

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eighty species are recognized, widely distributed through the Northern Hemisphere with three or four species in North America and many species in eastern Asia and Europe. Two native species are found in the Northeast. The European Mountain Ash or Rowan Tree, *Sorbus aucuparia* L., has become naturalized in the Northeastern States and eastern Canada.

Branchlets stout, terete. **Buds** large, covered by imbricated scales, the inner accrescent. **Leaves** alternate, deciduous, odd-pinnate with serrate leaflets, or simple and serrate; stipules foliaceous, free from the petioles. **Flowers** in broad, terminal, leafy, compound cymes; calyx-tube urn-shaped, 5-lobed; petals 5, white or rarely pink, rounded, abruptly narrowed at the base; stamens usually 20 in three series, those of the outer series opposite the petals; carpels 5 (usually 2—3), 2-ovuled, connate or partly free; styles free or connate at the base. **Fruit** a small, subglobose, red or orange-red pome with acidulous flesh and papery carpels which are free at the base; seeds two or one by abortion, chestnut-brown and lustrous, exalbuminous.

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| | Page |
| 1. Leaflets lance-oblong to lanceolate, acuminate; flowers about $\frac{1}{3}$ th of an inch in diameter; fruit about $\frac{1}{4}$ th of an inch in diameter | |
| | S. americana 295 |
| 1. Leaflets elliptic-oblong, rather blunt; flowers $\frac{1}{3}$ rd to $\frac{2}{3}$ ths of an inch in diameter | 2 |
| 2. Leaflets bright green and glabrous above, sharply and often somewhat doubly serrate to near the base, the teeth more or less spreading; winter-buds glutinous | S. decora 297 |
| 2. Leaflets dull green and somewhat pubescent above, serrate toward the apex and the lower third entire; winter-buds white-villous-tomentose | S. aucuparia 299 |

THE SERVICE BERRIES. Genus AMELANCHIER Med.

The genus *Amelanchier* includes trees and shrubs with slender unarmed branches, lanceolate buds covered with closely imbricated scales, simple petioled leaves, and racemose or rarely solitary flowers. The twenty-five or more species are widely distributed throughout the north temperate regions of both Hemispheres. In addition to the shrubby forms there are three arborescent species, all indigenous to North America, two in the eastern states and the third in the Rocky Mountain and Pacific Coast Region.

Leaves alternate, deciduous, simple, entire or serrate, petioled; stipules linear, caducous. **Flowers** borne on slender, bibracteolate pedicels in erect or nodding racemes, or rarely solitary, appearing with the leaves; calyx-tube campanulate or urceolate, adnate to the ovary, with 5 lanceolate, reflexed, persistent lobes; petals 5, white, oblong-obovate, spatulate or ligulate, with short claws; stamens numerous, inserted with

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the petals on the rim of the calyx-tube, with subulate filaments and oblong anthers; pistil consisting of a 5-celled but falsely 10-celled ovary terminated by 2—5 styles which are connate below and bear terminal, truncate stigmas; ovules erect, 2 in each cell. **Fruit** a small, berry-like, globose pome, maturing in our species in early summer, purplish or blue when ripe, crowned with the calyx-lobes and persistent stamens; flesh sweet, rather juicy; carpels membranaceous; seeds 5—10, oblong, compressed, exalbuminous.

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|--|--------------------------|
| 1. Leaves densely white-tomentose when young, at length becoming green; pedicels of fruit $\frac{3}{4}$ —1 inch long | A. canadensis 301 |
| 1. Leaves essentially glabrous from the first; pedicels of fruit 1—2 inches long | A. laevis 303 |

THE APPLES. Genus MALUS Mill.

Deciduous or rarely half-evergreen trees or shrubs with unarmed or rarely with spinescent branchlets, alternate simple leaves, showy flowers in umbel-like racemes, and pomaceous fruit (apples). This genus includes about twenty-five species in the temperate regions of North America, Europe, and central, southern, and eastern Asia. Nine native arborescent species occur in the United States, one of which is found in the Northeast. *Malus pumila* Mill., of southeastern Europe and central Asia, the apple-tree of our orchards, has become widely naturalized in the Northeastern States.

Leaves alternate, simple, serrate or those near the end of vigorous branchlets often incisely lobed, petioled, with filiform stipules which are early deciduous. **Flowers** white to pink or carmine, in umbel-like racemes on short, spur-like, sometimes spinescent branchlets; calyx-tube obconic, 5-lobed, the lobes persistent or deciduous on the fruit, petals usually suborbicular or obovate; stamens 15—50, usually with yellow anthers; ovary inferior, 3—5-celled, with 2—5 styles connate at the base. **Fruit** a pome (apple) with or without grit-cells; carpels papery, joined at the apex; seeds 2 (or by abortion one) in each cell, chestnut-brown, lustrous, exalbuminous.

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| 1. Branches spinescent; leaves ovate to ovate-oblong, glabrous or nearly so at maturity; petioles slender, glabrous; fruit 1—1 $\frac{1}{4}$ inches in diameter | M. coronaria 305 |
| 1. Branches not spinescent; leaves broad-elliptic to elliptic and obovate, pubescent or woolly beneath; petioles stout, pubescent; fruit 1—3 inches in diameter | M. pumila 307 |

THE PEARS. Genus PYRUS L.

Deciduous or half-evergreen, sometimes thorny trees or rarely shrubs of the Northern Hemisphere, chiefly of the Old World. Some twenty

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species are included in this genus one of which, the common pear, *Pyrus communis* L., has become widely naturalized in the Northeastern States.

Leaves alternate, deciduous or half-evergreen, simple, serrate, entire or rarely lobed, petioled, stipulate. **Flowers** with or before the leaves, in umbel-like racemes, white or rarely pinkish; sepals generally reflexed or spreading; petals suborbicular to broad oblong; stamens 20—30, usually with red anthers; styles 2—5, free, closely constricted at the base by the disk; ovules 2 in each loculus. **Fruit** a pome which is usually pyriform; flesh with numerous grit-cells; walls of loculi cartilagenous; seeds black or nearly black, exalbuminous.

PULSE OR PEA FAMILY. LEGUMINOSAE

An extremely large Family of about four hundred and thirty genera and seven thousand species including trees, shrubs, woody vines, and herbs, widely distributed through the tropical and temperate regions of the World. Many are valuable timber trees while others are important forage crops or are otherwise valuable to man. In addition to the many herbaceous and shrubby forms, there are eighteen genera which are represented by arborescent forms in the United States.

Leaves alternate, usually compound, stipulate. **Flowers** papilionaceous, falsely papilionaceous, or regular, usually perfect; stamens 10 (occasionally 5 or many), monadelphous, diadelphous, or rarely distinct; pistil simple, superior, solitary. **Fruit** a legume, sometimes indehiscent, follicular, or fleshy, often jointed between the seeds.

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| | Page |
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| 1. Leaves doubly pinnate, at least in part; flowers regular, polygamous or dioecious | 2 |
| 1. Leaves simple or pinnate; flowers papilionaceous or pseudo-papilionaceous | 3 |
| 2. Leaves bipinnate; calyx-tube elongated, 5-lobed; legume thick and woody, 4—10 inches long | Gymnocladus 430 |
| 2. Leaves pinnate and bipinnate; calyx-tube short, 3—5 lobed; legume coriaceous, 12—18 inches long | Gleditsia 431 |
| 3. Leaves simple; upper petal enclosed by the others in the bud | Cercis 431 |
| 3. Leaves pinnate; upper petal enclosing the others in the bud | Robinia 432 |

KENTUCKY COFFEE-TREE. GYMNOCLADUS L.

Large trees with stout pithy twigs, large alternate bipinnate leaves, inconspicuous flowers, and large woody legumes. A genus of two species, one native to eastern North America, the other to southern and southwestern China.

KEY TO GENERA AND SPECIES

Buds superposed. **Leaves** alternate, deciduous, unequally bipinnate, the primary pinnae aside from 1 or 2 basal pairs with many, usually alternate leaflets; stipules foliaceous, caducous. **Flowers** regular, dioecious or polygamous, greenish white, borne in terminal racemes; calyx elongated-tubular, 10-ribbed, with 5 narrow, nearly equal lobes; petals 5, oblong, equal, pubescent, spreading, somewhat longer than the calyx-lobes; stamens 10, distinct, short, inserted with the petals on the calyx-tube; filaments pubescent, of two lengths; pistil consisting of a sessile ovary terminated by a short style and oblique, 2-lobed stigma; ovules numerous. **Fruit** a large, oblong, subfalcate, somewhat compressed, woody legume, tardily dehiscent, containing several seeds separated by a jelly-like pulp; seeds large, ovoid or somewhat obovoid, albuminous, with thick, brown seed-coat.

THE HONEY LOCUSTS. Genus *GLEDITSIA* L.

A genus of ten or twelve species of trees, natives of eastern North America, central and eastern Asia, tropical Africa, and South America. Three species are found in the United States, one widely distributed in the East, a second inhabiting the lower Mississippi Basin, and a third restricted to a small area in Texas. But one species, *Gleditsia triacanthos* L., occurs within the range of this text.

Leaves alternate, deciduous, long-petioled, often fascicled on second-year twigs, even-pinnate, twice-pinnate or with some of the secondary pinnae replaced by simple leaflets; leaflets subsessile, irregularly crenulate; stipules small, caducous. **Flowers** regular, polygamous, small, greenish yellow, borne in slender, axillary, sometimes fascicled, spike-like racemes, with minute, caducous bracts; calyx campanulate, with 3—5 nearly equal lobes; petals 3—5, equaling the calyx-lobes; stamens 6—10, distinct, inserted with the petals on the edge of the disk; pistil consisting of a nearly sessile ovary terminated by a short style and terminal, dilated stigma; ovules 2-many. **Fruit** a compressed, many-seeded, elongated, straight, indehiscent legume or an ovate, 2-seeded, tardily dehiscent legume; seeds suborbicular or oblong, compressed, albuminous, with long funicles.

THE RED-BUDS. Genus *CERCIS* L.

A genus of eight species of small trees or shrubs, natives of North America, southern Europe and eastern Asia. Three species occur in North America, one widely distributed as a small tree in central and eastern United States, a second in southern Texas, New Mexico and adjacent Mexico, and the third a shrubby species in California.

Bark scaly. **Branchlets** slender, zigzag, prolonged by an upper axillary bud. **Leaves** alternate, deciduous, simple, ovate, orbicular or reniform, with 5—7 prominent veins; petioles slender, elongate, enlarged at the base; stipules small, membranous, caducous. **Flowers** appearing before or with the leaves on thin, jointed pedicels in simple fascicles or race-

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mose clusters, borne on the growth of the preceding season, on the older twigs, or even on the trunk, pink, pseudo-papilionaceous; calyx-tube oblique-campanulate, 5-toothed; petals 5, unguiculate, those forming the keel the larger and free; standard smaller than the wings and enclosed by them in the bud; stamens 10, distinct, declined; filaments enlarged and pilose at the base; anthers oblong; pistil consisting of a short-stalked, obliquely-inserted ovary terminated by a filiform style and stout, obtuse stigma; ovules numerous, 2-ranked. **Fruit** a linear-oblong, compressed legume, acute at both ends and margined along the upper suture, at maturity reddish purple and 2-valved; seeds oblong, compressed, reddish brown, albuminous.

THE LOCUSTS. Genus ROBINIA L.

A genus of about twenty species of trees and shrubs characterized by slender, zigzag, often armed branchlets, minute superposed subpetiolar buds, alternate odd-pinnate leaves, and showy papilionaceous flowers. The locusts are confined wholly to the temperate parts of North America. Of the species found in the United States, three are arborescent and two of these are naturalized in the Northeast.

Leaves alternate, deciduous, odd-pinnately compound; leaflets entire, petiolulate, with minute, bristle-like stipules; stipules persistent, spinescent at least on vigorous growth. **Flowers** large, showy, papilionaceous, perfect, borne on long pedicels in short, pendulous racemes from the axils of leaves of the year; calyx-tube campanulate, 5-lobed or cut, the upper lobes the longer and cohering for a part of their length; corolla consisting of a large, reflexed, obcordate standard, 2 oblong-falcate, free wings, and 2 obtuse, incurved keel-petals which are united below; stamens 10, diadelphous, the nine inferior united; anthers uniform or the alternate ones smaller; pistil superior, consisting of a stipitate, elongated ovary terminating in a subulate, inflexed, hairy style and a terminal stigma; ovules numerous, 2-ranked, attached to the ventral suture. **Fruit** a many-seeded, linear-oblong, compressed, nearly sessile legume, flat-margined along the seed-bearing suture and opening by 2 thin, membranous valves; the legumes are generally borne in drooping, many-fruited racemes and open tardily; seeds oblique, reniform, albuminous, with persistent incurved funicle.

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| 1. Branchlets, peduncles, and petioles glandular-viscid; flowers rose-color | R. viscosa 317 |
| 1. Branchlets, peduncles, and petioles not glandular-viscid; flowers white | R. pseudoacacia 319 |

RUE FAMILY. RUTACEAE

Trees, shrubs, or rarely herbs with bitter aromatic oil, simple or compound, generally glandular-punctate leaves, and perfect or poly-

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gamous, usually strongly-scented flowers. The Rue Family contains of in the neighborhood of one thousand species, grouped in about one hundred and twenty genera. The various species are widely distributed throughout the warm temperate and tropical regions of the World, some extending into temperate Eurasia and America.

Leaves simple or compound, generally glandular-punctate, estipulate or with spinescent stipules. **Flowers** regular, perfect or unisexual, chiefly in cymes; calyx 3—5-lobed, the lobes imbricated in the bud; petals 3—5, imbricated in the bud; stamens as many or twice as many as the petals, distinct or united below, hypogynous; pistils 2—5, separate or united, sessile or stipitate, the styles usually united; ovules 2 in each cell. **Fruit** a capsule, samara, drupe, or hesperidium; seeds albuminous.

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| 1. Leaves odd-pinnate or rarely trifoliate; infrastipular spines usually present; fruit composed of 1—5 dehiscent pods, each from a single carpel (simple pistil) | Zanthoxylum 433 |
| 1. Leaves trifoliate (rarely 4—5-foliate); infrastipular spines wanting; fruit a 2-seeded samara | Ptelea 433 |

THE PRICKLEY ASHES. Genus ZANTHOXYLUM L.

Deciduous or evergreen aromatic trees or shrubs, usually prickly and the spines generally in infrastipular pairs, with pinnate or rarely 3-foliate leaves, inconspicuous dioecious or polygamous flowers, and aggregate pod-fruits. About 150 species are included in this genus, distributed for the most part in the tropical and subtropical regions of both Hemispheres, a few in temperate regions. One species, *Zanthoxylum americanum* Mill., the Prickley Ash, is a weed-tree or large shrub in the Northeastern States.

Winter-buds small, superposed. **Stipular spines** usually present. **Leaves** alternate, odd- or even-pinnate or rarely trifoliate; leaflets opposite, sessile or subsessile, entire or serrate, with pellucid dots. **Flowers** in axillary or terminal, broad or contracted cymes, small, dioecious or polygamous, 3—8-merous; perianth simple or consisting of sepals and petals; disk small or obscure; stamens as many as the petals and alternate with them, with filiform or subulate filaments, rudimentary or wanting in the female flowers; pistils 1—5, raised on the summit of a fleshy gynophore, rudimentary in the male flowers; ovaries 1-celled, with a short style and capitate stigma, the styles more or less united toward the summit. **Fruit** composed of 1-several capsular pods, each derived from a single carpel (single pistil); mature carpels with a thin exocarp separating from the endocarp, 2-valved, each bearing a black, lustrous, albuminous seed.

THE WAFER-ASHES. Genus PTELEA L.

Small trees or shrubs with bitter bark, 3—5-foliate leaves, polygamous flowers, and samaroid fruit. The genus is endemic to North

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America and is represented by four or five species, natives of the United States and Mexico. One species becomes a small tree and is found locally in southern Ontario and New York State.

Leaves alternate or rarely opposite, estipulate, long-petioled, generally trifoliate, the leaflets ovate or oblong, entire or crenulate-serrate, pelucid-punctate. **Flowers** polygamous, greenish white, borne on slender, bracteolate pedicels in terminal or compound cymes; calyx 4—5-parted; petals 4—5, imbricated; stamens of the same number as the petals and alternate with them; filaments subulate, pilose at the base, shorter in the pistillate flowers; pistil consisting of a stipitate, compressed, 2—3-celled ovary terminated by a short style and 2—3-lobed stigma. **Fruit** a 2—3-celled, broadly winged or rarely wingless samara: wing broad, reticulate; seeds oblong, acute at the apex, rounded at the base.

QUASSIA FAMILY. SIMAROUBACEAE

Trees or shrubs with bitter juice, alternate or occasionally opposite pinnate leaves or the leaves rarely simple, dioecious or polygamous flowers, and a drupaceous or rarely samaroid or baccate fruit. This Family includes about one hundred and fifty species which are grouped in twenty-eight genera, and is chiefly confined to the tropics, a few species extending into temperate regions.

Leaves alternate, persistent or deciduous, pinnate, estipulate. **Flowers** regular, dioecious or polygamous; calyx 3—5-lobed, the lobes imbricated in the bud; petals 3—5, imbricated in the bud; disk annular or elongated; stamens as many as the petals or twice as many, distinct; filaments with a scale or hairs at the base, inserted under the disk; anthers 2-celled, introrse; pistil consisting of a 2—5-celled ovary terminated by a like number of styles. **Fruit** a drupe, samara, or berry.

TREE OF HEAVEN. Genus AILANTHUS Desf.

Trees or shrubs with pale bitter bark, pinnate leaves, greenish white flowers, and samaroid fruit. The genus contains eight or nine species, natives of eastern and southern Asia, and northern Australia. *Ailanthus altissima* Swingle has become widely naturalized about cities and towns in eastern United States.

Leaves alternate, petioled, deciduous, odd-pinnately compound, consisting of numerous, somewhat oblique, ovate or ovate-lanceolate, subentire leaflets. **Flowers** small, polygamous, greenish white, borne in large terminal panicles; calyx short, 5-cleft; petals 5, spreading, valvate; disk hemispheric, 10-lobed; staminate flowers ill-scented, with ten stamens; fertile flowers with 2—3 abortive or functional stamens; pistil consisting of a deeply 2—5-lobed ovary surmounted by a like number of united styles. **Fruit** a linear-oblong samara with membranous, veiny wing surrounding the 1-seeded seminal cavity; samaras generally clustered.

SUMACH FAMILY. ANACARDIACEAE

Trees, shrubs or vines with acrid resinous or milky juice, pithy branchlets, alternate or very rarely opposite, simple or compound leaves, generally polygamous flowers, and drupaceous fruit or the fruit a nut. A large Family comprising about sixty genera and some four hundred species, chiefly natives of the tropics or the milder portions of the Temperate Zones.

Leaves alternate or very rarely opposite, simple or pinnate, estipulate. **Flowers** regular, minute, dioecious, polygamous, or perfect; calyx-lobes generally 5; petals of the same number or wanting; stamens of the same number as the petals or twice as many and inserted with them on the edge of an annular disk; filaments filiform; anthers oblong, 2-celled, longitudinally dehiscent; pistil consisting of a 1-celled, 1-ovuled ovary terminated by 1—3 styles and stigmas. **Fruit** a small drupe or nut, rarely dehiscent; seed exalbuminous; cotyledons fleshy.

THE SUMACHS. Genus RHUS L.

The genus *Rhus* includes about one hundred and fifty species of trees, shrubs, and climbing vines, some poisonuos, chiefly natives of the milder portions of the North and South Temperate Zones. Certain species are important as sources of tannin material, lacquers, waxes, and gums; others are ornamental plants. Sixteen or seventeen species are indigenous to the United States and are scattered from coast to coast. Five of these become small trees.

Branchlets stout, pithy, exuding a milky or watery juice when bruised. **Leaves** alternate, deciduous or persistent, chiefly odd-pinnately compound. **Flowers** dioecious or polygamous, white or greenish white, borne in more or less compound, axillary or terminal panicles; calyx generally 5-cleft or 5-parted, persistent; petals 5, spreading, longer than the calyx-lobes; stamens 5, alternate with the petals, inserted with them under the margin of an annular disk; pistil consisting of a sessile ovary terminated by 3 terminal styles and stigmas. **Fruit** a globose, smooth or hairy drupelet, borne chiefly in thyrses; flesh thin, often acidulous; pit bony or crustaceous.

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| 1. Flowers in terminal, thyrsoid panicles; drupelet clothed with acid crimson hairs | 2 |
| 1. Flowers in loose, slender, axillary panicles; drupelet glabrous, white | R. vernix 327 |
| 2. Rachis of the leaf not winged; juice milky | 3 |
| 2. Rachis of the leaf winged; juice watery..... | R. copallina 329 |
| 3. Leaf-stalks and branchlets densely velvety-hairy | R. typhina 331 |
| 3. Leaf-stalks and branchlets glaucous | R. glabra 333 |

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HOLLY FAMILY. AQUIFOLIACEAE

Trees and shrubs with terete branchlets, scaly buds, alternate simple leaves, inconspicuous flowers, and a drupaceous fruit. A Family of five genera and more than three hundred species, widely distributed in the temperate and tropical regions of the World. One genus is represented by arborescent forms in the United States.

Leaves alternate, deciduous or persistent, simple, entire, crenate or pungently toothed, stipulate. **Flowers** greenish white, dioecious, axillary, solitary or cymose; calyx 4—6-lobed; petals 4—6, imbricated in the bud; stamens 4—6, alternate with the petals, attached to the petals at the base, reduced to staminodia in the pistillate flower; ovary 4—8-celled; style short or none; stigmas 4—8. **Fruit** a drupe with thin flesh, containing 4—8 horny or crustaceous nutlets; seeds pendulous, albuminous.

THE HOLLIES. Genus ILEX L.

A genus of about three hundred species of trees and shrubs, widely scattered throughout the temperate and tropical regions of the World with the exception of western North America, and Australia and the neighboring islands. The largest number of species occur in Brazil and the Guianas. Thirteen species are found in eastern United States, six of which become arborescent. Two of the latter extend into the North-eastern States.

For generic characters, see those of the family.

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| 1. Leaves persistent, coriaceous, with spinose teeth; staminate flowers in 3—9-flowered cymes; drupe about $\frac{1}{4}$ of an inch in diameter | |
| | I. opaca 335 |
| 1. Leaves deciduous, membranous, sharply serrate with gland-tipped teeth, staminate flowers in 1—2-flowered cymes; fruit about $\frac{3}{8}$ ths of an inch in diameter | |
| | I. dubia var. monticola 337 |

MAPLE FAMILY. ACERACEAE

Trees and a few shrubs with watery, often saccharine juice, terete branches, opposite simple palmately lobed or pinnate leaves, and polygamous or dioecious flowers. The *Aceraceae* consist of but two genera, *Dipteronia*, represented by two single species in China, and *Acer*, with numerous species widely distributed over the Northern Hemisphere.

Leaves opposite, deciduous, simple and usually palmately lobed or rarely pinnate, long-petioled, chiefly estipulate. **Flowers** regular, polygamous, dioecious, or rarely perfect, borne in lateral fascicles arising from separate flower-buds before the leaves or in terminal and lateral racemes or panicles with or after the leaves; calyx chiefly 5-parted, the

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segments imbricated; petals 5 or none; disk thick, annular, lobed, or sometimes lacking; stamens 4—10 (usually 7—8), hypogynous, with filiform filaments and oblong or linear anthers; pistil consisting of a 2-lobed, 2-celled, compressed, wing-margined ovary surmounted by 2 styles which are stigmatic on their inner surface; ovules 2 in each cell. **Fruit** a double samara, the halves long-winged (**Acer**) or broad-winged (**Dipteronia**), 1-seeded, and joined at the base; wings chartaceous or coriaceous, thickened on the margin; seed compressed, ascending, exalbuminous; cotyledons thin, folded.

THE MAPLES. Genus ACER L.

The genus *Acer* consists of about one hundred and fifteen species of trees and shrubs which are scattered over the Northern Hemisphere of the New and the Old World, one species crossing the Equator into Sumatra and Java. Thirteen arborescent species are found in the United States, seven of which occur within the area covered by this text. Some species are important timber trees producing close-grained, moderately hard or hard woods which are prized for furniture, for turnery, and for interior finish. Maple sugar is obtained from the sap of *A. saccharum* Marsh. The Maples are also used extensively as shade trees.

For generic characters, see those of the family.

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| 1. Leaves simple, palmately veined and lobed | 2 |
| 1. Leaves odd-pinnately compound | A. negundo 339 |
| 2. Flowers in dense, sessile, axillary clusters from lateral leafless buds | 3 |
| 2. Flowers in racemes, corymbs, or umbel-like corymbs, terminal on short leafy branchlets | 4 |
| 3. Petals wanting; sides of terminal lobe of leaf diverging | |
| | A. saccharinum 341 |
| 3. Petals present; sides of terminal lobe of leaf converging | |
| | A. rubrum 343 |
| 4. Flowers in racemes .. | 5 |
| 4. Flowers in corymbs or umbel-like corymbs | 6 |
| 5. Racemes erect at anthesis; leaves coarsely serrate, 3-lobed or slightly 5-lobed | A. spicatum 345 |
| 5. Racemes drooping at anthesis; leaves finely doubly serrate, 3-lobed at the apex | A. pennsylvanicum 347 |
| 6. Flowers in umbel-like corymbs, appearing with the leaves; leaves palmately 3—5-nerved and -lobed; petioles not exuding a milky juice when broken | 7 |
| 6. Flowers in corymbs, appearing before the leaves; leaves palmately 5—7- (usually 7) nerved and -lobed; petioles exuding a milky juice when broken | A. platanoides 349 |

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7. Leaves 3—5- (usually 5) lobed, rather thin, dark green above,
glabrous beneath **A. saccharum 351**
7. Leaves 3—5- (usually 3) lobed, rather thick, yellowish green above,
usually downy beneath **A. nigrum 353**

HORSE-CHESTNUT FAMILY. HIPPOCASTANACEAE

Trees or rarely shrubs with stout branchlets marked by large leaf-scars, opposite digitately compound leaves, showy irregular flowers in large terminal panicles or thyrsi, and capsular fruit bearing very large seeds. Three genera and over twenty-five species are included in this Family, distributed in the temperate regions of the Northern Hemisphere, in America extending into northern South America.

Branchlets stout, terete. **Winter-buds** large, scaly, subtended by large, triangular leaf-scars. **Leaves** deciduous, opposite, digitately 3—9-foliate, estipulate; leaflets lanceolate and elliptic to oblong-obovate and obovate, serrate. **Flowers** polygamo-monoecious, irregular, showy, white, red or pale yellow, racemose or nearly unilateral on the branches of large terminal panicles or thyrsi which appear after the leaves; sepals 4—5, distinct or connate, imbricate; petals 4—5, unequal, clawed; stamens 5—9, distinct; ovary superior, 3-celled with two ovules in each cell, capped by one style and stigma. **Fruit** usually 1-celled by abortion, dehiscent, 3-valved, usually 1-seeded; seeds very large (nut-like), with a large hilum, exalbuminous.

THE HORSE-CHESTNUT AND BUCKEYES.

Genus *AESCULUS* L.

Characters as for the Family.

Flowers in large, terminal panicles, generally only the lower flowers fertile; pedicels jointed; calyx campanulate, 5-lobed; petals 4—5, unequal, clawed; disk hypogynous, annular; stamens chiefly 7, with elongated, filiform, unequal filaments and introrse, longitudinally dehiscent anthers. **Fruit** capsular, coriaceous, 3-valved, 1—2-seeded, loculicidally dehiscent; seeds large, globose or hemi-spherical, smooth, lustrous brown with a large pale hilum; cotyledons thick, fleshy, hypogean.

The common Horse-Chestnut, *Aesculus hippocastanum* L., a native of the Balkan Peninsula, is extensively planted in the temperate regions of both Hemispheres, and has become naturalized in the Northeastern States. A number of other species including forms native to eastern United States but not to the area covered by this text, are grown as ornamentals in parks, cemeteries and about habitations but are not found as 'escapes.'

BUCKTHORN FAMILY. RHAMNACEAE

Small trees and erect or climbing shrubs with bitter bark, simple and mainly alternate leaves, and perfect, polygamous, or dioecious,

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inconspicuous flowers. The *Rhamnaceae* include about forty-five genera and more than five hundred and fifty species, chiefly natives of the tropics and the warmer parts of temperate regions. The genus, *Rhamnus*, is represented by one naturalized arborescent species in the Northeast.

Leaves simple, chiefly alternate and generally 3-nerved, stipulate. **Flowers** perfect or polygamous, regular, greenish, inconspicuous; calyx 4—5-lobed; petals 4—5, inserted on the calyx or wanting; stamens 4—5, opposite the petals; disk fleshy; pistil consisting of a sessile, 2—5-celled and -ovuled ovary surmounted by a columnar style and terminal stigma. **Fruit** drupaceous, winged, or capsular, tipped with the remnants of the style; seeds mainly albuminous.

THE BUCKTHORNS. Genus RHAMNUS L.

Small trees and shrubs with bitter bark, often spinescent branches, simple penniveined leaves, and greenish, perfect, polygamous or dioecious flowers. *Rhamnus* is represented by about one hundred species, chiefly native to the temperate regions of the Northern Hemisphere, some in Brazil and South Africa. Five species are indigenous to the United States; three of these become arborescent but none of these occur within the range of this text. *Rhamnus cathartica* L., which was introduced from Europe as an ornamental, has become widely naturalized in eastern United States.

Leaves alternate or subopposite, deciduous or persistent, simple, entire or dentate, petioled, conduplicate in the bud. **Flowers** perfect or polygamo-dioecious, axillary, borne in simple or compound racemes or fascicled cymes; calyx campanulate, 4—5-lobed; petals 4—5, emarginate, infolded around the stamens, or lacking; stamens 4—5, with short filaments and ovate-oblong or sagittate anthers; pistil consisting of a free, 2—4-celled, ovoid ovary surmounted by a 3—4-cleft or -lobed style. **Fruit** an oblong or spherical drupe with thick succulent flesh, with 2—4 1-seeded nutlets; seed erect, grooved, with scanty albumen.

LINDEN FAMILY. TILIACEAE

A large Family of trees, shrubs and herbs comprising about thirty-five genera and approximately three hundred species, mainly tropical and most abundantly represented south of the Equator. Three genera are North American, one of which, *Tilia*, is arborescent.

Leaves chiefly alternate, simple, deciduous, stipulate. **Flowers** perfect, regular, generally in cymes or panicles; sepals 3—5, valvate, deciduous; petals of the same number and fewer, or none; stamens numerous, generally 5—10-adelphous; pistil consisting of a sessile, 2—10-celled ovary terminated by a columnar style and capitate stigma. **Fruit** drupaceous or nut-like; seeds albuminous; cotyledons foliaceous.

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THE LINDENS OR BASSWOODS. Genus *TILIA* L.

The genus *Tilia* comprises about thirty species of trees and is widely distributed in the temperate regions of the Northern Hemisphere with the exception of western North America and central Asia. Most of the species are characterized by fragrant, nectar-bearing flowers, fibrous inner bark, and a soft, even-textured, valuable wood, and are valuable timber trees in the regions to which they are indigenous.

Leaves alternate, deciduous, simple, mainly cordate and inequilateral at the base, serrate, long-petiolate. **Flowers** perfect, pale yellow, fragrant, nectariferous, borne on slender clavate pedicels in axillary or terminal cymes, the stalk of the cyme in part adnate to the axis of a ligulate or obovate, pale green, membranous bract; sepals 5; petals 5, alternate with the sepals, creamy-white; stamens numerous, 5-adelphous, each cluster (in the American species) united with a petal-like scale opposite each petal; filaments forked at the apex, each fork bearing a half-anther; pistil consisting of a sessile, tomentose, 5-celled ovary surmounted by a columnar style and 5 spreading, stigmatic lobes. **Fruit** nut-like, woody, subglobose to ovate-oblong, 1-celled by abortion and containing 1—2 albuminous seeds; cotyledons palmately 5-lobed.

KEY TO THE SPECIES

- | | Page |
|---|--|
| 1. Leaves glabrous below aside from tufts of rusty-brown hairs in the axils of the prominent veins; fruit short-oblong to oblong-obovoid, $\frac{1}{3}$ — $\frac{1}{2}$ of an inch long | T. glabra 359 |
| 1. Leaves with short-white or -grayish tomentum below; fruit subglobose, about $\frac{1}{3}$ of an inch in diameter | T. heterophylla var. michauxii 361 |

GINSENG FAMILY. ARALIACEAE

Trees, shrubs, or herbs with watery juice, alternate compound leaves, racemose or paniced umbels of flowers, and baccate fruit. A large Family of about fifty genera and more than five hundred species, mainly confined to the tropics with a few genera extending into the Northern Hemisphere. *Aralia* is represented by four species in the Northeastern States, one of which becomes a small tree.

Leaves alternate, deciduous, compound, petioled, mainly stipulate. **Flowers** perfect or polygamous, regular, 5-merous, in racemose or paniced umbels; calyx adnate to the ovary, 5-lobed; petals 5 or 10, inserted on the margin of the calyx; stamens 5 or 10, alternate with the petals; pistil consisting of an inferior, 2—5-celled ovary surmounted by 2—5 styles and simple stigmas; ovules one to each cell. **Fruit** a 2—5-seeded, baccate drupe; seeds exalbuminous.

HERCULES' CLUB. Genus *ARALIA* L.

Aromatic spiny trees and shrubs with stout pithy branches, or

KEY TO GENERA AND SPECIES

bristly or glabrous perennial herbs. The genus comprises about twenty species and is confined to North America, Asia, Malaya and Australia. *Aralia spinosa* L., is the only North American species which becomes arborescent.

Leaves alternate, pinnately or ternately decompound, the petioles enlarged and clasping at the base; stipules present. **Flowers** perfect or polygamous, small, greenish white, 5-merous, borne on slender, jointed pedicels in umbels or panicked umbels; calyx-tube adherent to the ovary, the lobes minute and valvate; petals ovate, imbricated in the bud; stamens alternate with the petals, with filiform filaments and oblong or ovate anthers, inserted with the petals on the margin of the disk; pistil consisting of an inferior, 2—5-celled ovary surmounted by a like number of styles and capitate stigmas. **Fruit** a 2—5-seeded, laterally compressed or angled, baccate drupe, tipped with the remains of the styles and calyx-lobes; nutlets orbicular to ovate-oblong, compressed, 1-seeded; seeds albuminous.

TUPELO FAMILY. NYSSACEAE

Deciduous trees with terete branchlets, alternate leaves, imperfect flowers in axillary or terminal heads, and drupaceous fruit. About eight species are included in this Family, distributed in three genera. The Family is confined to eastern North America, western China, Tibet and the Himalaya, and the Malay Archipelago. The *Nyssaceae* are sometimes included in the *Cornaceae*.

Leaves alternate, simple, entire or toothed, estipulate. **Flowers** dioecious or polygamous, in axillary or terminal heads; calyx minute in the staminate flowers, 5-toothed and adnate to the ovary or indistinct in the pistillate flowers; petals 5 or more, or wanting; stamens twice as many or fewer than the petals, usually in two series; ovary 1-celled or 6—10-celled; ovules solitary; style subulate or conic, with simple or divided stigma. **Fruit** a drupe, crowned with the remnants of the calyx.

THE TUPELOS. Genus NYSSA L.

Trees with alternate simple leaves, inconspicuous polygamo-dioecious flowers, and drupaceous fruit. *Nyssa* is represented by four species in eastern United States and two species in eastern and southern Asia. One species, *N. sylvatica* Marsh., occurs in the Northeastern States.

Leaves alternate, deciduous, simple, entire or angulate-toothed, petioled, generally grouped near the ends of the branches. **Flowers** appearing before the leaves, polygamo-dioecious, small, greenish white, inconspicuous, borne in capitate clusters, short racemes, or solitary at the summit of slender axillary peduncles; staminate flowers numerous; calyx 5-parted; petals 5, minute, fleshy, or none; stamens 5—15, with slender filaments and oblong anthers; fertile flowers solitary or in few-flowered clusters, subtended by bracts; calyx-limb 5-toothed or trun-

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cate; petals 5, minute, or none; stamens 5—10, with short filaments and fertile or abortive anthers; pistil consisting of an inferior, 1-celled, 1-ovuled ovary surmounted by a slender curved style stigmatic on one side toward the apex. **Fruit** an oblong or ovoid drupe, with thin acidulous flesh and a thick-walled, bony, terete or compressed, ridged or winged, generally 1-celled, 1-seeded pit; seed pale, filling the cavity of the pit.

DOGWOOD FAMILY. CORNACEAE

Trees, shrubs, or herb-like shrubs with watery juice, terete branchlets, alternate or opposite deciduous leaves, and perfect or polygamodioecious flowers. The Family includes ten genera and about ninety species, natives of the temperate and subtropical regions of the North Temperate Zone. One genus, *Cornus* L., has arborescent species in North America.

Leaves deciduous, alternate or opposite, simple, entire or rarely toothed or lobed, estipulate. **Flowers** borne solitary or grouped in heads, cymes, or panicles, regular, perfect or rarely unisexual, epigynous; calyx-tube adnate to the ovary, its limb rarely 4- or 5-toothed, or the teeth wanting; petals 4 or rarely 5, or sometimes wanting; stamens as many as the petals, usually inserted on the margin of an epigynous disk; ovary inferior, 1—2-celled and -ovuled, surmounted by a simple style and stigma. **Fruit** a 1-pitted, 1—2-celled and -seeded drupe; seeds oblong, albuminous.

THE DOGWOODS OR CORNELS. Genus CORNUS L.

Trees, shrubs, or shrub-like herbs, with astringent bark, opposite or rarely alternate leaves, small perfect flowers, and drupaceous fruit. The genus comprises nearly fifty species, confined to the temperate regions of the Northern Hemisphere except for a single species in Peru. Some seventeen species occur in the United States, four of which become arborescent.

Leaves opposite or rarely alternate, simple, deciduous. **Flowers** perfect, small, white, greenish white, or yellow, 4-merous, borne in cymes or heads, the latter subtended by four showy white bracts in some species; calyx adherent to the ovary, the limb minutely 4-toothed; petals 4, valvate in the bud; stamens 4, alternate with the petals and inserted with them on the margin of the disk, the filaments slender and exserted; pistil consisting of an inferior 2-celled, 2-ovuled ovary surmounted by a columnar style and capitate or truncate stigma. **Fruit** an oblong or ovoid drupe, with thin flesh and bony or crustaceous, 2-seeded stone.

KEY TO THE SPECIES

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| 1. Leaves opposite; flowers greenish, capitate, the heads subtended by 4 large, white, involucre bracts; fruit red | Page Cornus florida 367 |
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KEY TO GENERA AND SPECIES

1. Leaves alternate; flowers creamy-white, in naked cymes; fruit dark blue **Cornus alternifolia** 369

SUBCLASS 3. GAMOPETALAE

Plants with petals more or less united (sometimes separate or wanting).

HEATH FAMILY. ERICACEAE

Trees and shrubs with scaly buds, alternate simple leaves, perfect regular flowers, and capsular, drupaceous or baccate fruit. A large Family with seventy-one genera and about one thousand five hundred species, widely scattered in both Hemispheres, chiefly in the colder and temperate regions, also on high mountains in the tropics. Twenty-one genera are represented in the United States, seven of which include arborescent forms. Two of these genera are found within the range of this text, each represented by one arborescent species.

Leaves alternate, simple, stipulate. **Flowers** perfect, regular, 4- or 5-merous; calyx 4—5-lobed, free or adnate to the ovary; corolla regular, 4—5-lobed, the lobes imbricated in the bud; stamens as many or twice as many as the lobes of the corolla, with short filaments and anthers opening by a terminal pore and often appendaged; pistil consisting of a 4—10-celled superior or inferior ovary terminated by a columnar style and capitate stigma. **Fruit** capsular, drupaceous, or baccate; seeds generally minute, albuminous.

KEY TO THE GENERA

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|---|---------------------------|
| 1. Leaves flat; flower clusters axillary; corolla 5-lobed | Page Kalmia 443 |
| 1. Leaves revolute; flower clusters terminal; corolla 5-cleft | Rhododendron 444 |

THE LAURELS. Genus KALMIA L.

Small trees and shrubs, evergreen or rarely deciduous, with terete branchlets, minute axillary leaf-buds, elongated axillary inflorescence-buds, and fibrous roots. About eight species are recognized, natives of the United States and the West Indies. One species *Kalmia latifolia* L., becomes arborescent in eastern United States.

Leaves alternate, persistent, entire, short-petioled. **Flowers** perfect, showy, pink, purple or white, borne on slender bibracteolate pedicels from the axils of persistent bracts in axillary umbels; calyx 5-parted, persistent, the lobes imbricated in the bud; corolla saucer-shaped, 5-lobed, with short tube and 10 pouches just below the limb, the lobes ovate and before anthesis prominently 10-ribbed from the pouches to the acute apex of the bud; stamens 10, shorter than the corolla, with oblong anthers and filiform filaments; prior to anthesis the anthers are

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retained in the pouches of the corolla but at maturity the stamens straighten abruptly and catapult the pollen grains from terminal pores in the anthers; disk 10-lobed; pistil consisting of a subglobose, 5-celled, many-seeded ovary terminated by a filiform exerted style and capitate stigma. **Fruit** a subglobose, crustaceous, 5-celled capsule which is tardily septicidally dehiscent; seeds minute, albuminous.

THE RHODODENDRONS. Genus RHODODENDRON L.

Small trees and shrubs, evergreen or deciduous, with astringent juice, scaly bark, terete branchlets, alternate leaves, and showy flowers. The genus includes over four hundred species, widely scattered over the colder and temperate regions of the Northern Hemisphere, also on high mountains in southern Asia and Malaya and extending to New Guinea and Australia. Twenty-three or -four species occur in North America, one of which, *Rhododendron maximum* L., is arborescent. Horticulturists have introduced and hybridized many exotic forms for ornamental purposes.

Leaves alternate, clustered near the ends of the branchlets, persistent, coriaceous, with revolute entire margins and broad midribs, short-petioled. **Flowers** perfect, showy, arising from scaly, cone-like buds, borne in terminal corymbs or panicles; calyx 5-parted or toothed, persistent; corolla campanulate, 5-cleft, deciduous; disk fleshy, lobed; stamens generally 10, somewhat unequal, declined and spreading; filaments pilose at the base; pistil consisting of a 5-celled ovary surmounted by a slender, exerted, persistent style and capitate stigma. **Fruit** a 5-celled, 5-valved, many-seeded, septicidally dehiscent capsule; seeds numerous, minute, laciniately winged at the ends, albuminous.

EBONY FAMILY. EBENACEAE

Trees and shrubs with watery juice, alternate simple entire leaves, dioecious or polygamous flowers, and baccate fruit. The *Ebenaceae* include six or seven genera and about two hundred and seventy-five species, widely distributed in the tropics and in the milder parts of temperate regions.

Leaves simple, alternate, entire, estipulate. **Flowers** small, regular, chiefly dioecious or polygamous, axillary, solitary or cymose; calyx inferior, persistent, 3—7-lobed; corolla regular, deciduous, 3—7-lobed; stamens more numerous than the lobes of the corolla and inserted on its tube, with short filaments and introrse anthers; pistil consisting of a several-celled ovary surmounted by 2—8-styles and stigmas; ovules 2 in each cell. **Fruit** a 1-several-seeded berry subtended by the accrescent calyx; seeds albuminous.

THE PERSIMMONS. Genus *DIOSPYROS* L.

Diospyros includes about two hundred species, widely distributed throughout the tropics and subtropics of the World but most abundant in southern Asia. The genus extends into the temperate regions of eastern Asia, eastern North America, and the Mediterranean area. The ebony of commerce is produced by certain members of this genus and others produce edible fruit. *Diospyros* is represented by two species in the United States, one of which, *P. virginiana* L., extends as far north as southern Connecticut.

Leaves alternate, simple, coriaceous, entire, estipulate. **Flowers** regular, dioecious, polygamous, or occasionally perfect, arising from the axils of the leaves of the year or of the previous year; staminate flowers smaller than the pistillate, usually in short, few-flowered cymes; pistillate flowers chiefly solitary; calyx 3—7-lobed, persistent and usually accrescent; corolla regular, 3—7-lobed, the lobes convolute in the bud; stamens 2—3 times the number of the corolla-lobes, inserted at the base of the corolla in two rows and in pairs, with slender filaments and oblong, apiculate anthers, abortive in the pistillate flowers; pistil consisting of an inferior, 3—7-celled ovary surmounted by 3—7 spreading styles, each bearing a 2-lobed or -parted stigma at the apex. **Fruit** a globose, oblong or conical, 1—10-seeded berry, subtended at the base by the accrescent, persistent calyx; seeds oblong, compressed, albuminous.

OLIVE FAMILY. OLEACEAE

Trees or shrubs with watery juice, scaly buds, opposite estipulate leaves, perfect, dioecious or polygamous flowers, and capsular, baccate, drupaceous, or samaroid fruit. This Family includes twenty-five genera and over four hundred species, widely distributed in temperate and tropical regions but chiefly in the Northern Hemisphere. Five genera are indigenous to the United States, four of which are arborescent. One genus has arborescent representatives in the Northeast.

Leaves opposite, simple or compound, estipulate. **Flowers** regular, perfect, dioecious or polygamous, paniculate, cymose, or fasciculate; calyx inferior, 2—4-lobed, or none; corolla of 2—4 petals, or none; stamens 2—4, with short filaments and introrse, often apiculate anthers; pistil consisting of a 2-celled ovary surmounted by a single style and terminal stigma. **Fruit** a samara or berry in the American species; seeds albuminous.

THE ASHES. Genus *FRAXINUS* L.

Trees and shrubs with stout pithy branches, opposite odd-pinnate or occasionally simple leaves, dioecious, polygamous or rarely perfect flowers, and samaroid fruit. The genus *Fraxinus* includes about sixty-five species, widely distributed in the Northern Hemisphere, in America

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south to Mexico, in Asia south to Java. Eighteen species occur in the United States, seventeen of which are arborescent. Some of our most valuable timber trees are included among these. Three species and a variety of one of these are indigenous to the Northeastern States.

Leaves opposite, deciduous, odd-pinnately compound or rarely reduced to a single leaflet, petioled; leaflets generally serrate, petiolulate or sessile. **Flowers** dioecious, polygamous, or rarely perfect, vernal, borne on slender pedicels in open or compact panicles which are terminal or axillary on shoots of the year or axillary on the growth of the preceding season; calyx small and campanulate, or none; corolla 2—4-parted, or none; stamens chiefly 2, with short filaments and large, oblong anthers; pistil consisting of a mostly 2-celled ovary crowned by a simple style and 2-lobed stigma. **Fruit** a samara with terete or somewhat compressed, chiefly 1-seeded body and terminal wing; seed elongated, exalbuminous.

KEY TO THE SPECIES

- | | Page |
|---|--|
| 1. Leaflets petiolulate; body of the fruit essentially terete; wing not extending to the base | 2 |
| 1. Leaflets sessile; body of the fruit compressed; wing extending to the base | 3 |
| 2. Leaflets obscurely serrate, pale beneath | 3 |
| 2. Leaflets sharply serrate, bright green beneath | 3 |
| | F. pennsylvanica var. lanceolata 383 |
| 3. Petioles and branchlets glabrous or nearly so | F. americana 379 |
| 3. Petioles and branchlets velvety-pubescent | F. pennsylvanica 381 |

THE FIGWORT FAMILY. SCROPHULARIACEAE

Herbs, shrubs, vines, and a few trees, with simple opposite, whorled or alternate leaves, mainly perfect, irregular and usually showy flowers, and capsular or baccate fruit. The Family includes about one hundred and eighty genera and three thousand species, widely distributed through tropical and temperate regions. In addition to many herbs, *Paulownia* Sieb. et Zucc. is represented by an arborescent species which has become naturalized as far north as New York City.

Leaves simple, variously arranged, estipulate. **Flowers** generally perfect, complete, irregular and often zygomorphic, generally showy; calyx 4—5-toothed, -cleft or -divided, persistent; corolla more or less irregular, mainly 2-lipped; stamens 2, 4 or 5, generally didynamous, inserted on the corolla-tube, with long, slender filaments and 1—2-celled anthers; pistil consisting of a 2-celled, many-ovuled ovary surmounted by a slender, usually simple style and simple or 2-lobed stigma. **Fruit** capsular and 2-valved, or baccate; seeds numerous, albuminous.

THE PAULOWNIA TREE. PAULOWNIA Sieb. et Zucc.

Trees with watery juice, stout pithy branches, opposite simple leaves,

showy paniculate flowers, and capsular fruit. The genus contains about ten species, natives of China. *Paulownia tomentosa* (Thunb.) Steud., has become naturalized as an 'escape' around New York City.

Leaves large, simple, opposite, deciduous, cordate, pubescent, long-petioled, estipulate. **Flowers** large, showy, violet in color, borne on stout, velvety pedicels in large, terminal panicles; calyx persistent, 5-cleft, the lobes short and obtuse; corolla-tube hairy without, 5-lobed, the lobes unequal and spreading; stamens 4, didynamous, with slender filaments and wide-spreading anther-sacs; pistil consisting of a 2-celled, many-ovuled ovary surmounted by a long style which is thickened and stigmatic toward the apex. **Fruit** a broadly ovoid, woody, abruptly pointed, 2-celled capsule, 1—2 inches long, opening loculicidally at maturity but persisting on the trees into the winter; seeds small, numerous, lace-winged.

TRUMPET-CREEPER FAMILY. BIGNONIACEAE

Trees, shrubs, lianas, and a few herbs with watery juice, opposite, whorled or rarely alternate, simple or compound leaves, generally showy flowers, and capsular fruit. The Family includes about one hundred genera and in the neighborhood of six hundred species widely distributed in the tropical and subtropical regions of both Hemispheres, some extending into temperate regions. Five genera are represented in the United States, three of which are arborescent.

Leaves simple or compound, opposite, whorled or rarely alternate, estipulate. **Flowers** large, showy, perfect, more or less irregular; calyx bilabiate; corolla somewhat bilabiate, 5-lobed, the lobes imbricated in the bud; stamens 2 or 4, inserted at the base of the corolla, introrse; staminodia 1—3; pistil consisting of a 1—2-celled, many-ovuled ovary surmounted by a slender, 2-lobed style stigmatic at the apex. **Fruit** a linear, woody, loculicidally or septifragally deliscent, 2-valved capsule; seeds exalbuminous.

THE CATALPAS. Genus CATALPA L.

Rapidly growing trees with stout, terete, pithy branchlets, opposite or whorled leaves, showy paniculate flowers, capsular fruit, and soft durable wood. The genus *Catalpa* includes about ten species, natives of the eastern United States, the West Indies, and eastern Asia. Two species have become sparingly naturalized in the Northeast and several foreign species are grown as ornamentals.

Leaves large, simple, entire or sparingly lobed, long-petioled, opposite or in whorls of three, deciduous. **Flowers** large, showy, borne on slender, bracteolate pedicels in terminal, trichotomously-branched, compound panicles or corymbs; calyx bilabiate in opening; corolla broadly campanulate, oblique, membranaceous, variously spotted within, with spreading, 2-lipped, 5-lobed limb; corolla-lobes undulate; stamens 2, ascending

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under the anterior lip of the corolla, with flattened, arcuate filaments and divergent anther-cells; staminodia 3, free, filiform, or rudimentary; pistil consisting of a sessile, 2-celled ovary contracted above into an elongated, filiform style bearing 2 stigmatic lobes at the apex. **Fruit** an elongated, subterete, pod-like capsule, loculicidally dehiscent, persisting on the trees during the winter; seeds numerous, compressed, oblong, with broad, lateral, fimbriate wings, inserted in 2—4 ranks near the margin of a flat, more or less thickened, woody septum.

KEY TO THE SPECIES

| | Page |
|---|----------------------------|
| 1. Leaves long-pointed at the apex; flowers in few-flowered open panicles; fruit stout, thick-walled | C. speciosa 387 |
| 1. Leaves abruptly contracted to an acuminate apex; flowers in many-flowered crowded panicles; fruit slender, thin-walled | C. bignonioides 389 |

HONEYSUCKLE FAMILY. CAPRIFOLIACEAE

Shrubs, small trees, lianas, or rarely perennial herbs with watery juice, scaly buds, opposite leaves, cymose flowers, and baccate drupaceous, capsular or achenoid fruit. The Family includes thirteen genera and about four hundred species, widely distributed in the Northern Hemisphere but with a few species in the mountains of the tropics and southward. Two genera are represented by arborescent species in the United States.

Leaves opposite, petioled, mainly estipulate. Flowers regular, perfect borne in terminal or axillary compound cymes; calyx-tube adnate to the ovary, 5-toothed; corolla epigynous, 5-lobed and sometimes 2-lipped; stamens 5, inserted on the tube of the corolla and alternate with its lobes, with slender filaments and oblong anthers; pistil consisting of an inferior or partly inferior, 1—5-celled, 1—5-ovuled ovary terminated by a short style and 3—5-lobed, capitate stigma. **Fruit** a 1—5-celled berry, drupe, capsule or achene; seeds albuminous.

THE NANNY-BERRIES, ETC. Genus VIBURNUM L.

Shrubs and small trees with tough flexible branchlets, opposite deciduous leaves, cymose flowers, and drupaceous fruit. The genus includes approximately one hundred species, widely distributed in the north temperate regions of the New and the Old World, a few extending into the tropics and southward. Fifteen species occur in North America, three of which become arborescent in the Atlantic States.

Buds enveloped in a single pair of scales, or naked, generally large. **Leaves** opposite, simple, deciduous, chiefly estipulate; petioles often broad at the base. **Flowers** white or rarely pink, showy, borne on short, bracteolate pedicels in flat, compound cymes, the outer flowers sometimes radiant and neutral; calyx-tube cylindrical, with short, evenly

KEY TO GENERA AND SPECIES

5-lobed limb, persistent in fruit; corolla rotate, evenly 5-lobed, spreading and reflexed after anthesis; stamens 5, inserted on the base of the corolla and alternate with the lobes, exserted, with elongated filaments and bright yellow anthers; pistil consisting of a 1-celled, inferior ovary surmounted by a conical style bearing 3 stigmatic lobes at the apex. **Fruit** a 1-celled, 1-seeded drupe with soft pulp and thin-crustaceous, tumid or compressed stone. Two arborescent species of **Viburnum** occur within the range of this text.

KEY TO THE SPECIES

- | | Page |
|---|---------------------------|
| 1. Leaves ovate to elliptic-obovate, at least the upper caudate-acuminate | V. lentago 391 |
| 1. Leaves broad-elliptic or occasionally ovate or obovate, rounded, acute, or short-pointed at the apex | V. prunifolium 393 |

DERIVATION OF THE NAMES OF TREES

By C. C. FORSAITH and A. REHDER

LINGUISTIC SOURCES OF TREE NAMES

As a correlative to that section of the glossary devoted to the derivation of the names of trees, a brief review of the historical sequence of those languages in which these terms had their origin may not be out of place. Languages, like the trees themselves, have undergone a progressive evolution from the time when man first showed his superiority over the lower animals by designating the objects around him by specific sounds. At first these were few and cumbersome, but as new ideas were born he created new titles for them. In the end, he had a working vocabulary by which he could pass on to his off-spring the fund of knowledge which he had gained. Primitive man, forced as he was to secure a precarious living in a hostile environment, soon recognized that trees were not all similar and even while his store of facts was meagre he had singled out the more conspicuous representatives and had given them names. These articulate ideas in ever-changing form were transmitted from generation to generation, from tribe to tribe, and from age to age.

Often the mutation in nomenclature has been so great that all evidences of relationship to an earlier tongue has been lost, while in other cases the form has remained quite stable for a period of time antecedent to historical records. These words, among which there are many terms for plants, reveal much concerning primitive culture, migration of peoples, and contact with alien races.

As might readily be expected much of our arborescent terminology is of Aryan derivation, and many of the words go back even to the parent Indo-European which is believed to have had its birth among the nomadic peoples inhabiting the level stretches of the Russian Steppes. From this point, pastoral hordes, encumbered with their flocks, extended in all directions. One group went south into Greece where they in time gave up the tribal state and built cities. In spite of their contact with the more advanced peoples to the southeast, they progressed along their own lines and were among the first of the Aryans to evolve a high civilization. They developed a written language which has preserved for us numerous ideas which would have doubtless been lost if they had been forced to depend alone upon verbal inheritance. Another group went farther west into Italy, became Empire builders, and imposed their customs upon their less progressive neighbors. The Greeks reached a high plane as scientists, and to them we are indebted for much of our earliest botanical information. The Romans never attained as high a place as investigators. They were borrowers for the most part, and their chief influence was exerted as missionaries whose duty it was to carry Hellenic culture and science to the corners of an extensive empire, as the progenitors of a lusty linguistic offspring in the present

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Romance languages, and as the standard-bearers of a high civilization and learning. The last group in which we are interested, the Germanic or Teutonic, spread through the north of Europe. They became subdivided into three main branches, the high German, the Norse (the Swedish, Danish, etc.), and the Low German, which became again divided into the Anglo-Saxon, the Dutch, and Scotch. To this last group we are beholden for a very large percentage of the common names of trees.

With this brief review of the migrations of the Aryan races we may consider the origin of the names of a few trees which may throw some light upon man's early botanical knowledge, his migratory paths, and his contacts with other peoples.

As might naturally be supposed only a few of these names are sufficiently ancient to appear in the Sanskrit, or are distinctly similar in all the Aryan branches. Many of the trees with a more westerly range were, of course, unknown to the early nomads, others by their lack of striking features may have escaped notice, while the names of some may have been forgotten or unrecognizably changed during the vicissitudes of prolonged migrations.

The characteristic and widely distributed pine was doubtless well known long before the dawn of history since it is recorded in Sanskrit as **pitu**. In the Greek **πίτυς**, the name retains its ancient form, but becomes **Pinus** in Latin, **pin** in French, and **pine** in English. In its earlier form it may be allied to the word for pain. The peculiar white bark of the birch was perhaps responsible for its separation from the less spectacular trees, as the primitive Aryan called it **bhurjas**, from **bhrja**, to shine. One other going back to the Indo-Germanic is **daru**, which means tree or larch. The Greek represents one of the most fertile of all fields owing in large part to a high scientific culture and a well developed literature. Most of their names come to us through the Latin as has already been explained. Our word prune or plum has been derived from **πρῶμνον** or **πρῦνος** through the Latin **Prunus**. Many names came into the Latin after contact was common, and the cultural Greek words may have supplanted an earlier Latin name for certain trees, among which **φαγός**, **ragus**; **μήλον**, **Malus**; and **πλάτανος**, **Platanus**, may be mentioned. Others came as a result of trade often accompanied by an actual transplanting of the tree as in the case of **ἀκακία**, the **Acacia** from Egypt.

Those which are strictly Latin in form are rare, and doubtless represent those which were restricted to Italy or were sufficiently well known to withstand the Greek influence. Among this group **Quercus**, the oak; **Abies**, the fir; **Pyrus**, the pear; and **Fraxinus**, the ash, are examples. It is but natural that the extensive trade fostered by the Roman Empire should bring foreign trees to their knowledge, and **Persica**, the peach, from the Persian **pars**, apparently came through the commercial route.

The Teutonic from which our own language was developed has furnished us with many common names, names originating after the separation from the Hellenic and Roman branches, but which had become so firmly rooted that they could not be replaced by the more cultural terms brought by their southern conquerors. Some of our best known words

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may be classified here, as, for example, the aspen, ash, and hawthorn. The restriction of these names to the common category is, of course, due to the early influence of the ecclesiastical Latin on literature and science.

A knowledge of many species came into England as a result of the Norman Conquest and later French influence. The Laurel from the Fr. **laurier**, through the M. E. **laurer**, the Mulberry from **mor**, through the M. E. **mool**, and the Sumach from **sumac**, indicate that the continental doubtless introduced into the British Isles those plants with which he had become acquainted by contact with the peoples to the south.

Very few names of trees are non-Aryan in origin, and one of the best examples is that of the Maple, and its earlier L. name **Acer** which is Celtic and may be a relic of the Roman occupation as may also be true of **sal-lis** (*Salix*).

Special incidents or changes in the lives of a people may exert no small influence on the language, and in this connection it may be well to mention two plants which came into England as a result of Christianity. Rose is a direct descendant of the L. **Rosa** from the Gr. **ῥόδον**, and the Lily, Gr. **λείριον**, comes from the same sources, although cases are exceedingly rare where the words are of Semitic origin in spite of the influence of Hebrew on Christianity.

In new regions new trees are encountered and in many cases the aboriginal nomenclature is chosen as the technical, as in **Hicoria** from the Indian **powchohiccora**. In the same way **Tsuga** comes from Japan, while Hemlock is Anglo-Saxon and refers to species of the herbaceous **Cicuta**.

These very few and incomplete examples will show that no small amount of history is bound up in the names of trees, and those who are competent to make a real study of the problem may be able to clear up many disputed points as to prehistoric migrations, conquests, lines of trade, and other ethnological problems. Plants are especially well adapted to such a study both because primitive peoples knew them, and because they have quite a definite distribution which may serve to geographically limit peoples or to tell from whence they came.

EXPLANATION OF TERMS USED IN THE GLOSSARY OF TREE NAMES

In a compilation of the etymological origin of any series of words, errors are likely to appear as divergence among authors bears testimony. The writer has in no case relied upon his own judgment, but, using the best sources available, has acted merely in an editorial capacity.

The following symbols and abbreviations have been used:

A. S.—Anglo-Saxon. The language of the Germanic invaders of England.
Aryan—Indo-European.

E.—English.

fr.—from an earlier source.

Fr.—French.

Ger.—German.

Gr.—Greek.

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Heb.—Hebrew.

Icel.—Icelandic.

I. E.—Indo-European, the extinct parent tongue of the European and some Asiatic languages.

I. G.—Indo-Germanic—Indo-European.

L.—Latin.

L. L.—Late Latin.

M. E.—Middle English—the language of England fr. 1100—1500.

O. E.—Old English.

O. F.—Old French.

O. H. G.—Old High German.

Pers.—Persian.

Skt. or Skr.—Sanskrit; the language of the early invaders of India which has been preserved in the Veda. It is believed to include more Indo-European derivatives than any other branch.

Sp.—Spanish.

sp.—species.

spp.—species (plural).

Sw.—Swedish.

Teut.—Teutonic, the parent language of the N. W. European group.

*****—Akin to or of parallel descent from an earlier common source.

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- Abies**—The ancient L. name for the European Fir, now the name for the genus; also the specific name of *Picea abies*.
- Acacia**—Fr. the Gr. *ἀκασία* (akasia), the thorn tree of Egypt, from *akis*, a thorn, through the L. *Acacia*. The common name of several species of the *Leguminosae*.
- Acer**—L. L. generic name for the Maple. From the Celtic *ac*, hard, referring to the quality of the wood.
- aceroides**—L. L. (maple-like) fr. *Acer*, maple, and *oides*, like (see *amygdaloides*). The specific names of *A. negundo* under the generic name *Negundo*.
- acuminata**—L. (sharp-pointed) fr *acuminare*, to make sharp, referring to the sharp teeth on the leaves of *Quercus acuminata* (synonym of *Q. muhlenbergii*) and the pointed leaflets of *Fraxinus acuminata* (synonym of *F. americana*).
- Aesculus**—L. referring to the European "mast tree" (the L. common name, perhaps, of *Quercus aesculus*).
- Ailanthus**—L. L. for "ailanto," the Chinese common name for the tree, and referring to the height in the native habitat.
- alba**—L. (white), a word allied to the Gr. *ἄλφος* (alphos) through the Sabine *alpum*; referring to the white wood of *Carya alba* and *Quercus alba*; to the white under surfaces of the leaves of *Salix alba* and *Populus alba*; to the white fruit of *Morus alba*; and to the glaucous foliage of *Picea alba* (synonym of *P. glauca*).
- Alder**—M. E. *aldir* or *aller*, A. S. *aler*, fr. the L. common name, *alnus*; the common name of species of *Alnus*.
- Alnus**—the old L. common name for the Alder (which see).
- alternifolia**—L. (alternate-leaves) from *alter*, other, *-nus*, belonging to, and *-folium* fr. the Gr. *φύλλον* (phullon), leaf; referring to the alternate leaves of *Cornus alternifolia*.
- altissima**—superlative of the L. *altus*, high; referring to the height of *Ailanthus altissima*.
- amara**—L. (bitter) referring to the bitter kernel of *Carya amara* (synonym of *C. cordiformis*, the Bitternut).
- ambigua**—L. (uncertain, doubtful); *Quercus ambigua* (synonym of *Q. borealis*) was considered a doubtful variant of the common Red Oak.
- Amelanchier**—L. L. fr. the common name of a species in Savoy, of uncertain origin.
- americana**—L. L. (America), referring to the geographical range of several species.
- amygdaloides**—L. (like an almond) fr. the Gr. *ἀμύγδαλος* (amugdalos), the almond, and *oides*, appearing like; referring to the peach-like or almond-like leaves of *Salix amygdaloides*.
- Amygdalus**—L. (the almond) fr. the Gr. *ἀμύγδαλος* (amugdalos); referring to a group of Asiatic trees among which are included *A. persica*, the Peach, and *A. communis*, the Almond.
- Apple**—fr. the A. S. *aepl*—origin unknown, * in the Teutonic languages. The common name for *Malus pumila*.
- Aralia**—a generic name of unknown origin.
- Arbor Vitae**—fr. the L. *arbor*, tree; and *vitae*, of life. The common name of *Thuja occidentalis*.
- Ash**—fr. the Teut. type *askiz*, through the A. S. *aesc*. * in all Teut. languages. The common name of *Fraxinus*.
- Asimina**—an early Fr. name for the Pawpaw, corrupted from the Algonquin *rassimina*, sleeve-fruit.
- Aspen**—(*asp* and *en*—an adj. ending as in wood *en*) fr. the A. S. *aespe*. * in Teut. languages. The common name for *Populus tremuloides*.

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- atropunicea**—L. (dark red) from *ater*, dark or black, and *punicea*, red; applied to *Fagus atropunicea* (synonym of *F. grandifolia*), through confusion with the European Copper Beech (*F. sylvatica* var. *atropunicea*).
- aucuparia**—from L. *aucupari*, to catch birds, because in Europe the fruits of *Sorbus aucuparia* were used as a bait in bird-catching.
- aurantiaca**—L. L. from Skr. *negrungo* through Hindustani *marungee* and Italian *arancia*, latinized *aurantium*, usually meaning orange-colored; in *Maclura aurantiaca* (synonym of *M. pomifera*), referring to the color and appearance of the fruit.
- avium**—L. (genetive pl. of *avis*, bird); translation of the common name "bird cherry" (*Prunus avium*, the European Wild Cherry).
- babylonica**—L. (Babylon) through the Gr. βαβύλων, (babulon); referring to the supposed origin of *Salix babylonica*.
- Balm of Gilead**—fr. the L. *balsamum* (see *balsamea*) through the Fr. *basme* and the M. E. *balm*, and Gilead (?). The common name of *Populus candicans*.
- Balsam**—fr. the L. *balsamum* (see *balsamea* and *balm*). The common name of *Abies balsamea*.
- balsamea**—L. (the balsam tree) fr. the Semitic [Heb.] *balsam*, through the Gr. βάλαμον, (balsamon) and the L. *balsamum*. Here referring to the resin-pockets in the bark of *Abies balsamea*.
- balsamifera**—L. (balsam-bearing) fr. *balsamum*, resin, and *ferre*, to bear; referring to the resinous exudation of the buds of *Populus balsamifera* (synonym of *P. tacamahaca*).
- banksiana**—L. L. adj. of the surname Banks. *Pinus banksiana* is named in honor of Sir Joseph Banks, English botanist (1743-1820).
- barbatum**—L. (bearded) fr. *barba*, beard; referring to the hairy and pendulous (beard-like) inflorescence of *Acer barbatum* (synonym of *A. saccharum*).
- Bass**—corrupt form of *bast* fr. the A. S. *baest*. The common name of *Tilia* species, probably because of the strong fibrous bark.
- Basswood**—See under "bass" and "wood." The common name of *Tilia* species.
- Bay**—fr. the L. *baeca*, a berry, through the Fr. *baie*. The common name of species of *Laurus* owing to the fruit, and of *Salix pentandra* owing to the laurel-like leaves; see also Sweet Bay.
- bebbiana**—L. L. adj. of the surname Bebb. *Salix bebbiana* is named in honor of Michael S. Bebb (1833-1895).
- Beech**—fr. the I. G. *bhagos*, a tree with edible fruit; through the A. S. *bece*, and the M. E. *beech*, * the Gr. φηγός (phegos) and the L. *Fagus* (which see). The common name of *Fagus*.
- berry**—fr. the A. S. *berie*, berry or fruit. * in the Germanic group of languages.
- Betula**—L. for the common Latin name of the Birch, a word allied to the Skt. *Bhurja*, to shine, referring to the shiny character of the bark.
- bicolor**—L. (two-colored) fr. *bis*, twice or two, and *color*, color; referring to the green upper and whitened lower surfaces of the leaves of *Quercus bicolor*.
- bignonioides**—L. L. (Bignonia-like) fr. *Bignonia*, a plant named for Abbe Bignon, and *oides*, like. A specific name given to *Catalpa bignonioides* and referring to similarity of the flowers to those of *Bignonia*.
- Bilsted**—A common name of *Liquidambar styraciflua*, perhaps from *bil* (obsolete of *bill*—A. S. *bile*), beak as of a bird, and *sted* or *stead* (A. S. *stede*), a place of or for. Possibly in reference to the beaked fruit of this species.
- Birch**—fr. the Skt. *bhuria*, fr. *bhurja*—to shine, through the A. S. *birce* and the M. E. *birche* * to the Aryan series. See *Betula*, the generic name of Birch.
- borealis**—L. (pertaining to the north) fr. the Gr. Βορέας, (Boreas), God of the north winds; referring to the northern habitat of *Quercus borealis*.
- Box elder**—Box fr. the Gr. πύξος, (puxos) through the L. *buxus*, the box-

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wood, *Buxus sempervirens*, and the A. S. *box*, and elder (which see). The common name of *Acer negundo* owing to the hardwood (?) and elder-like leaves.

Broussonetia—L. L. fr. the surname Broussonet. A generic name given in honor of the naturalist, Auguste Broussonet.

Buckthorn—from M. E. *buk*, A. S. *buc*, Skr. *bukka*, meaning he-goat, and *thorn*, which see. The common name of *Rhamnus cathartica*, perhaps in reference to the fact that the foliage of this species was eaten by goats.

Butternut—Butter fr. the Gr. βούς (bous), ox and τυρός (tuross), cheese, through the L. *butryum*, and nut fr. the A. S. *hnutu* through the M. E. *nut*,* the Teutonic group. The common name of *Juglans cinerea* owing to the oily meat of the nut.

Buttonwood—fr. the M. E. *boton*, a button or bud, Fr. *bouton*, something pushed out fr. *bouter*, to push, and *wood* (which see). A common name of *Platanus occidentalis* because of the spherical button-like fruits.

canadensis—L. L., referring to the geographical range of several species.

candicans—L. *candicare*, to be whitish; possibly referring to the whitish bark of *Populus candicans*.

canina—L. (belonging to the dog); used mostly in a derogatory sense as something of little value, as in *Celtis occidentalis* var. *canina*.

caroliniana—L. L. (Carolina), referring to the geographical range of several species.

Carpinus—L. The common Latin name for the Hornbeam.

Carya—L. L. from the Gr. καρύα (karua), the Greek name of the Walnut Tree.

Castanea—L. from the Gr. καστανέα (kastanea), chestnut. See also under chestnut.

Catalpa—L. L. from the Cherokee common name, *catawba*. The tree was discovered by Catesby in 1728.

cathartica—L. (a purgative) fr. the Gr. καθαρών (katharo), to cleanse, — through καθαρτικός (kathartikos); referring to the cathartic properties of the bark of *Rhamnus cathartica*.

Cedar—fr. the Gr. κέδρος (kedros) through the L. *cedrus* and the A. S. cedar. The common name of several of the *Cupressinaceae*.

Celtis—A name given by Pliny to the African Lotus (probably *Zizyphus lotus*) and later transferred to the present genus on account of the sweet fruit of the European *Celtis australis*.

cerasus—The old L. name of the cherry tree fr. the Gr. κεράσος (kerasos), a tree brought by Lucullus from Asia Minor.

Cercis—L. L. fr. the Gr. κερκίς (kerkis), the ancient name for the Judas Tree.

Chamaecyparis—L. (low-cypress) fr. the Gr. χαμαί (chamai), on the ground, and κυπάρισσος (kyparissos), the Cypress.

Cherry—fr. the Gr. κεράσος (kerasos) through the L. *cerasus* (which see), the O. F. *cerise*, and the M. E. *cherry*. The common name of some species of *Prunus*.

Chestnut—fr. the Gr. κάστανον (kastanon) through the L. *castanea* (which see), the Italian *castagna*, the Fr. *chataigne*, and the M. E. *chestein*, chesten-nut (see Butternut). The common name of *Castanea*.

Chinquapin—fr. the North American Indian word for *Castanea pumila*, and those species of *Quercus* with chestnut-like leaves.

cinerea—L. (ash-colored) fr. the Gr. κόνις (konis) through the L. *cineris*, dust; referring to the color of the bark of *Juglans cinerea*.

coccinea—L. (scarlet or crimson) fr. *coccum*, a gall growing on *Quercus coccifera* which was used in making red dyes (?). The word comes from the Gr. κόκκος (kokkos), a seed or berry; referring to the scarlet autumn-leaves of *Quercus coccinea*.

Coffee Tree—fr. the Arabic *quahweh* through the Turkish *cauphe*, meaning coffee, and 'tree' (which see). The common name of *Gymnocladus dioica* owing to the coffee-like seeds.

communis—L. (common) fr. *com-munis*, ready to be of service; referring to a general and abundant distribution of several species.

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- copallina**—L. L. fr. the Mexican *copal*, the name of a white resin from a species of *Rhus* in Mexico; referring to the latex in the bark of *Rhus copallina*.
- cordifolia**—L. L. (heart-shaped) fr. *cor*, *cordis*, heart, and *folium*, leaf; referring to the heart-shaped leaves of *Catalpa cordifolia* (synonym of *C. bignonioides* and *C. speciosa*), and of *Betula papyrifera* var. *cordifolia*.
- cordiformis**—L. (heart shaped) fr. the L. *cor*, *cordis*, heart, and *forma*, shaped; referring to the shape of the fruit of *Carya cordiformis*.
- Cornel**—fr. the L. *cornus* (which see) through the L. L. *cornolium*. The common name of *Cornus*.
- Cornus**—The L. common name for the Cornel fr. *cornu*, horn; referring to the hardness of the wood.
- coronarius**—L. from *corona*, crown or wreath; referring to the use of certain flowers for wreaths; applied to *Malus coronaria* on account of its handsome flowers.
- Cottonwood**—Cotton fr. the Arabic *qutn* through the Sp. *coton*, the Fr. *coton*, and the M. E. *cotoun*, and wood—fr. the A. S. *wudu* through the M. E. *wode*, * the Teutonic and Galic where it refers to a tree. The common name of *Populus deltoides* owing to the comose seeds.
- Crabapple**—Crab fr. the M. E. *crabbe*, implying poor quality, and apple (which see). Applied to *Malus coronaria* and other small-fruited apples.
- Crataegus**—L. (the hawthorn) fr. the Gr. *κρᾱταίγος* (*krataigos*), a word derived from *κράτος* (*kratos*), strength, owing to the hardness of the wood of the trees belonging to this genus.
- Cucumber Tree**—cucumber fr. the L. *cucumis*, a name referring to the process of ripening by heat, fr. *coquere*, to cook, through the M. E. *cucumer* (cucumber), and tree (which see). The common name of *Magnolia acuminata* owing to the shape of the fruit.
- Cupressus**—L. (cypress) fr. the Gr. *κυπάρισσος* (*kuparissos*); a word of earlier Semitic origin.
- Cypress**—fr. the L. *Cubressus* through the Fr. and M. E. *cipres*. See *Cubressus*. The common name of *Taxodium distichum* owing to the similarity of the cones to those of *Cupressus*.
- damascena**—L. (of Damascus) fr. Damascus, a city of Asia Minor famous for its fruit culture; referring to the origin of *Prunus damascena* (synonym of *P. domestica*).
- dasyacanthum**—L. (thick fruit) fr. the Gr. *δασύς* (*dasus*), thick, and *καρπός* (*karpos*), seed; referring to the fruit of *Acer saccharinum* (?).
- decidua**—from the L. *de*, down, and *cadere*, to fall; referring to the deciduous habit of *Larix decidua*.
- decora**—L. (handsome) fr. *decor*, beauty; referring to the handsome fruit of *Sorbus decora*.
- deltoides**—L. (like the letter D), from the Gr. *δέλτα* (*delta*), D, and *ῖδης*, like; referring to the leaves of *Populus deltoides*.
- dentata**—L. (having teeth) fr. *dens*, *dentis*, a tooth; referring to the dentate margins of the leaves of *Castanea dentata*.
- dioicus**—L. L. (two-houses) fr. the Gr. *δύς* (*dis*), two and *οἰκία* (*oikia*), house; referring to the dioecious or polygamous flowers of *Gymnocladus dioica*.
- Diospyros**—L. L. from the Gr. *δῖος* (*dios*), of God, and *πῶός* (*puos*), wheat or food. A tree with cherry-like fruit (probably *Diospyros lotus*, a Mediterranean species).
- discolor**—L. (two-colored) fr. *dis*-, two, and *color*, color; referring to the difference in color of the upper and lower surfaces of the leaves of *Salix discolor*.
- divaricata**—L. (spread apart) fr. *dis*-, apart or two, and *varicare*, to spread; referring to the spreading branches of *Pinus divaricata* (synonym of *P. banksiana*).
- domestica**—L. (domestic) fr. *domus*, house; referring to the cultivation of *Prunus domestica* about houses.

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- dubia**—L. (doubtful) fr. *duo*, two, between two points; alluding to the doubtful botanical standing of *Ilex dubia*.
- echinata**—L. (covered with spines) fr. the Gr. ἐχίνοσ (echinos), through the L. *echinus* (hedgehog or sea urchin, hence a spine), and the suf. *atus*, covered with; referring to the armed cones of *Pinus echinata*.
- Elder**—fr. the A. S. *ellaern*, * the Germanic, i. e., Ger. *ahorn*, Maple. Allied to the word hollow in reference to the hollow twigs. The common name of *Sambucus*. See also Box Elder.
- ellipsoidalis**—L. L. (ellipsoidal) fr. ellipse, Gr. ἑλλειψις (elleipsis), originally defect, in geometry a plane curve of certain proportions, and *oides*, like an ellipsoid; in geometry a solid shaped like an ellipse; referring to the shape of the fruit of *Carya ovata* var. *ellipsoidalis*.
- Elm**—fr. the A. S. *elm*, * the Ger. *Ulm*, and the L. *Ulmus* (which see). The common name of species of *Ulmus*.
- eugenei**—gen. of the latinized Christian name, Eugene; *Populus canadensis* var. *eugenei* was named by Gabriel Simon of Metz, for his son Eugene, who later traveled in China and introduced *Populus Simoni*, named in his honor.
- excelsa**—fr. the L. *excellere*, to excel, meaning more exactly, from the top; referring to the large stature of *Picea excelsa* in comparison to other European conifers.
- Fagus**—L. (the beech) fr. the Gr. φαγεῖν (fagein), to eat, through the Dorian φαγός (fagos), the Beech, in reference to the edible fruit of the genus.
- ferruginea**—L. (rust-colored, dark) fr. *ferrum*, iron, through *ferrugo*, rust; apparently referring to the dark-colored one- or two-year branches of *Fagus ferruginea* (synonym of *F. grandifolia*).
- Fir**—fr. the Ger. *Forha* through the A. S. *furu*, perhaps of Scandinavian origin * the Teutonic group. The common name of *Abies* species.
- florida**—L. (abounding in flowers) fr. *flos*, *floris*, a flower; referring to the showy inflorescences of *Cornus florida*.
- fragilis**—L. (fragile) fr. *frangere*, to break; referring to the easily broken branches of *Salix fragilis*.
- fragrans**—L. (fragrant) fr. *fragrans*, emitting fragrance; referring to the fragrant flowers of *Malus fragrans* (synonym of *M. coronaria*).
- fraxinifolia**—L. L. (ash-leaved) fr. *Fraxinus*. Ash, and *folium*, leaf; referring to the resemblance of the leaves of *Carya ovata* var. *fraxinifolia* to those of the Ash.
- Fraxinus**—L. The L. common name of the Ash Tree.
- fulva**—L. (yellowish brown, dark yellow); referring to the color of the pubescence of the winter-buds of *Ulmus fulva*.
- glabra**—L. (smooth); referring to the smooth leaves of several species, and the smooth, non-corky bark of *Ulmus alabra*.
- glandulosa**—L. (provided with glands) from *glaus*, nut or gland, and *osus*, provided with; referring to the prominent glands on the leaflets of *Ailanthus glandulosa* (synonym of *A. altissima*).
- glauc**—L. (bluish) fr. the Gr. γλαυκός (glaukos); referring to the glaucous undersurface of the leaves of *Magnolia glauca* and the glaucous leaves of *Picea glauca*.
- Gleditsia**—L. L. from the surname Gleditsch, and named for J. G. Gleditsch, a contemporary of Linnaeus.
- glutinosa**—L. (viscid, full of glue); fr. *glutinum*, glue, and *osus*, full of; referring to the viscid branchlets of *Robinia glutinosa* (synonym of *R. viscosa*).
- grandidentata**—L. (large-toothed) fr. *grandis*, large, and *dentatus*, toothed (see dentate); referring to the large dentations on the leaf-margins of *Populus grandidentata*.
- grandifolia**—L. (large leaf) fr. *grandis*, large, and *folium*, leaf; referring to the size of the leaves of *Fagus grandifolia*.
- Gum**—fr. the Egyptian *Kami*, through the Gr. κόμμι (kommi), the L. *gummi*, the Fr. *gomme*, and the M. E. *gomme*; referring to the hardened

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- juices of certain trees. The common name of species of *Nyssa*, and of *Liquidambar styraciflua*, owing to gummy exudations.
- Gymnocladus**—L. L. (naked branches) from the Gr. γυμνός (gumnos), naked, and κλάδος (klados), branch; referring to the sparse branching of the two species of this genus, especially as seen in winter condition.
- Hackberry**—hack=hag berry (see Hawthorn) and berry (see Mulberry). The common name of *Celtis occidentalis*.
- Hackmatack**—fr. the North American Indian name, *hakmantak* (see Belknap—History of N. H., Ill.—“On some mountains we find a shrubbery of hemlock and spruce, whose branches are knit together so as to be impenetrable. The snow lodges on their tops, and a cavity is formed underneath. These are called by the Indians, ‘hackmantaks’.” Transferred as the common name of *Larix laricina*.
- Hamamelis**—L. L. from the Gr. ἡ αμυγδάλος (Hamamelis), Greek name for the Service Tree or Medler; derived from ἡμα (hama), at the same time, and αἰνῶν (melon), an apple- or fruit-tree; transferred to *Hamamelis virginiana*.
- Haw**—see under Hawthorn.
- Hawthorn**—haw—fr. the A. S. *haga*, an enclosure or hedge, * to the Teutonic group, perhaps fr. *hagon*, an enclosure, and thorn fr. the Skt. *trna*, a blade of grass through the A. S. *þorn*, a sharp point * Teutonic group. The common name of *Crataegus* species owing to their use for hedges.
- Hemlock**—fr. the A. S. *hemlock*, a name referring to species of *Cicuta*. The common name of *Tsuga canadensis* owing to the resemblance of its foliage to the dissected leaves of *Cicuta*; originally called Hemlock-fir or Hemlock-spruce.
- heterophylla**—L. (variously formed leaves) fr. the Gr. ἕτερος (heteros), different, and φύλλον (phullon), leaf; referring to the leaf-form of *Tilia heterophylla* and *Populus heterophylla*.
- Hicoria**—L. L. from Hickory which see; a synonym of *Carya*.
- Hickory**—fr. the North American Indian *powcohiccora*; referring to the Indian custom of securing a milk from the pounded nuts. The common name of species of *Carya*.
- hippocastanum**—L. L. name of the horse-chestnut from the Gr. ἵππος (hippos), horse, and κάστανον (kastanon), chestnut; referring to the use of the fruit as medicine for horses by the Turks. The epithet “horse” is also often used in a derogatory sense, meaning an *inferior kind*.
- hirta**—L. (hairy); referring to the woolly branches of *Rhus hirta* (synonym of *R. Typhina*).
- Holly**—fr. the A. S. *holen* through the M. E. *holyn*. Perhaps from the Teut. *kolenno* * to the Celtic. The common name of species of *Ilex*.
- Hornbeam**—horn—fr. the A. S. *horn* * to the Aryan group (see *Cornus*). and beam from the A. S. *beam*, a tree, the Teutonic, i. e., the Ger. *baum*. The common name of species of *Ostrya* and *Carpinus* owing to the hard wood.
- Horsechestnut**—See under “hippocastanum.”
- Ilex**—L. (holly), the L. common name of the holly oak. *Quercus Ilex*, referring to the resemblance of the leaves of species of the genus *Ilex* to those of Holly Oak.
- ilicifolia**—L. *ilicis*, genitive of *Ilex* (which see), and *folium*, leaf; referring to the leaf type of *Quercus ilicifolia*.
- Imperialis**—L. (imperial). The specific name of *Paulownia imperialis* (synonym of *P. tomentosa*), referring to the imperial rank of Princess Anna Pavlovna after whom the tree is named.
- incana**—L. *incana*, gray or hoary; referring to the leaves of *Alnus incana* which are whitened beneath.
- inops**—(destitute, poor) from *in*, without, and *ops*, abundant, plenty, alluding to the slight value of *Pinus inops* (synonym of *P. virginiana*) as a timber tree.
- insititia**—L. (inserted, grafted) fr. *inserere*, to graft, or *insitio*, grafting; referring to the improved fruit of *Prunus insititia*, in comparison to that of the Wild Sloe, *P. spinosa*.

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- Judas Tree**—Judas fr. the Heb. *Judas* since Judas is said to have hanged himself from a limb of *Cercis siliquastrum*, and 'tree' (which see). The common name of *Cercis* species.
- Juglans**—L. (walnut or the nut of Jupiter), the old L. common name fr. *Jupiter*, genitive of Jovis, and *glans*, nut.
- Juniper**—fr. the L. *Juniperus* (which see). The common name of species of *Juniperus*.
- Juniperus**—the L. common name for the genus to which the Red Cedar belongs.
- Kalmia**—L. L. fr. the surname Kalm, and referring to Peter Kalm, a student of Linnaeus who visited America.
- laciniosa**—(shreddy, dissected) fr. *lacinia*, tip, shred; referring to the shaggy bark of *Carya laciniosa*.
- laevis**—L. *laevis* or *levis* (smooth); referring to the glabrous leaves of *Ame-lanchier laevis*.
- lanceolata**—L. (lance-shaped) fr. *lanceola*, diminutive of *lancea*, lance; referring to the shape of the leaflets of *Fraxinus pennsylvanica* var. *lanceolata*.
- Larch**—fr. the Skt. *daru*, a tree, through the L. *Larix*, which see The common name of *Larix*.
- laricina**—L. (pertaining to the larch) fr. *Larix*, the Larch.
- Larix**—The L. common name for the Larch. The common name, "Larch," comes directly from this word.
- latifolia**—L. (broad leaf) fr. *latus*, broad, and *folium*, leaf; referring to the broad leaves of *Kalmia latifolia*.
- Laurel**—fr. the L. *Laurus*, a laurel-tree, through the Fr. *laurier* and the M. E. *laurer*. The common name of *Kalmia* and *Ilex* species owing to their similarity to *Laurus*.
- laurifolia**—L. (laurel-leaf) fr. *Laurus*, laurel, and *folium*, leaf; referring to the shining leaves of *Salix laurifolia* (synonym of *S. pentandra*).
- lenta**—L. (limber, tough, or supple); referring to the character of the branches of *Betula lenta*. Perhaps * the I. G. *lent* (see Linden).
- lentago**—L. L. from *lentus* (supple, flexible); *lentago* was one of the L. L. names of the European *Viburnum lantana* transferred by Linnaeus to the American *V. lentago*.
- Lime**—see Linden.
- Linden**—Lind em (see aspen), Lind, Line or Lime Tree all of which are fr. the I. G. *lent*, through the A. S. *lind* and Teut. *lenda* * the Arvan group, i. e., the Gr. ἐλάτη (*elate*), a fir tree. The common name of *Tilia*.
- Liquidambar**—L. (liquid-amber) fr. *liquidus*, *liquid*, and the Arabic *ambar*, an allusion to juices exuding from this tree.
- Liriodendron**—L. (lily-tree) fr. the Gr. λείριον (*leirion*), lily, and δένδρον (*dendron*), tree; referring to the showy flowers of the genus *Liriodendron*.
- Locust**—prob. fr. the L. *locusta*, the insect-locust. The common name of several species of the *Leguminosae* owing to the character of the flowers.
- lucida**—L. (bright or shining) fr. *lux*, *lucis*, light, through *lucere*, to shine; referring to the shining leaves of *Salix lucida*.
- lutea**—L. (pale yellow) fr. *lutum*, mud or clay; referring to the color of the bark of *Betula lutea*.
- Maclura**—L. L. from the surname Maclure, and named for Wm. Maclure, the American geologist.
- macrocarpa**—L. L. (large-fruit) fr. the Gr. μακρός (*makros*), large, and καρπός (*karpos*), seed, from κάρφω (*karpho*), to dry; referring to the large acorns of *Quercus macrocarpa*.
- Magnolia**—L. from the surname Magnol, and named for Peter Magnol, Professor of Botany at Montpellier, in the 17th century.
- mahaleb**—direct from the Persian. The seeds of the tree were used in the manufacture of perfumes. This common name became the specific name of *Prunus mahaleb*.
- Malus**—L. (apple), the common name fr. the Gr. μήλον (*melon*), through the Doric μάλον (*malon*).

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- Maple—fr. the A. S. *mapul*, perhaps allied to the Ger. *masshold*. The common name of *Acer* spp.
- mariliana**—referring to Maryland; same as *marilandica*.
- marilandica**—L. L. (Maryland); referring to the geographical range of *Quercus marilandica*.
- maximum**—L. (largest), superlative of *magnus*, large; referring to the size of *Rhododendron maximum* as compared to other species of this genus, and to the size of the acorns of *Quercus borealis* var. *maxima*.
- Mazzard**—fr. O. H. G. *masar*, a knot of maple wood, through the Fr. *maser*, and the M. E. *maser*. The common name of *Prunus avium*.
- michauxii**—L. L. from the surname Michaux; referring to Francois Michaux, the botanist. Name given to *Tilia heterophylla* var. *michauxii*.
- megacarpa**—L. L. (large-fruited) fr. the Gr. μέγας (megas), large, and καρπός (karpos), fruit; referring to the comparatively large fruit of *Carya glabra* var. *megacarpa*.
- microcarpa**—L. (small seed) fr. the Gr. μικρός (mikros), small, and καρπός (karpos), seed; referring to the small fruits (seeds) of *Carya microcarpa*.
- minima**—L. (smallest), superlative of *Parvus*, small; comparative, *minor*, smaller; referring to the small fruits of *Carya minima* (synonym of *C. cordiformis*).
- minor**—L. (smaller); referring to the small stature of *Quercus minor* (synonym of *Q. stellata*).
- mitis**—L. (weak, soft) in reference to the slightly or scarcely prickly cone of *Pinus mitis* (synonym of *P. echinata*) in contra-distinction to the very prickly cone of *P. virginiana*.
- monilifera**—L. (necklace-bearing) from *monile*, a necklace, and *ferre*, to bear; referring to the pendulous aments of *Populus monilifera* and *P. deltoides* var. *monilifera* (synonyms of *P. deltoides*).
- monogyna**—L. L. (one-styled) fr. the Gr. μόνος (monos), single, and γυνή (gune), woman or in botany, 'style'; referring to the single style of the flower of *Crataegus monogyna*.
- montana**—L. (pertaining to the mountain) from *mons*, *montis*, mountain; referring to the habitat of *Quercus montana*, *Ulmus montana* (synonym of *U. glabra*), and of *Ilex montana* (synonym of *Ilex dubia* var. *monticola*).
- monticola**—L. (mountain-dweller) fr. *mons*, mountain, and *colere*, to dwell; referring to *Ilex monticola* (synonym of *I. dubia* var. *monticola*).
- Mockernut**—The common name of *Carya tomentosa*. The word "mock" may refer to the thick shell or to a similarity of the fruit to that of *Carya ovata*.
- Morus**—L. (the mulberry) fr. the Gr. μόρεα (morea).
- muhlenbergii**—L. L. for the surname Muhlenberg, named for H. L. Muhlenberg (1756-1817).
- Mulberry**—fr. the L. *Morus* (which see), through the Fr. *mor*, and the M. E. *mool*, and berry fr. the Skt. *bhas*, to eat, through the A. S. *berge*. The common name of species of *Morus*.
- multiflora**—L. (many-flowered) fr. *multus*, many, and *flos*, *floris*, flower; referring to the flower heads of *Nyssa multiflora* (synonym of *N. sylvatica*).
- nana**—L. (dwarf) fr. the Gr. νᾶνος (nanos); referring to the comparatively low stature of *Quercus nana* (synonym of *Q. ilicifolia*) and *Prunus nana* (synonym of *P. virginiana*).
- Nannyberry**—colloquial name of the female goat, and berry (which see). The common name of *Viburnum lentago*, possibly referring to the peculiar odor of the various plant parts, including the wood.
- negundo**—L. L. from the Malayan common name of *Vitex negundo*; transferred to *Acer negundo* on account of the similarity of the leaf.
- nigra**—L. (black) referring to the dark leaves of *Picea nigra* (synonym of *P. mariana*), the dark color of the wood of *Juglans nigra*, the dark bark of *Quercus nigra* (synonym of *Q. marilandica*), the darker foliage of *Acer nigrum* in comparison to that of *A. saccharum*, and the darker

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- foliage of *Fraxinus nigra* in comparison to that of other *Fraxinus* species.
- nivea**—L. (snowy) fr. *nix*, *nivis*, snow; referring to the white underside of the leaves of *Populus alba* var. *nivea*.
- Nyssa**—L. L. from the Gr. νύσα (Nusa), a nymph and the nurse of Bacchus; the name given by Linnaeus to a genus based on *Nyssa aquatica* which grows in water.
- Oak**—fr. the Teut. *aiks* through the A. S. *ac*, and the M. E. *oke*, * the Aryan group, i. e., the Gr. αἰγ- ἰλωψ (aig-ilops), an oak tree. The common name of species of *Quercus*.
- obcordata**—L. L. (inversely heart-shaped) fr. *cordata*, heart-shaped, fr. *cor*, *cordis*, heart, and *ob*-, prefix signifying inversion; referring to the shape of the nut of *Carya ovalis* var. *obcordata*.
- obovalis**—L. L. (inversely egg-shaped) from L. L. *ovalis*, egg-shaped, and *ob*-, prefix signifying inversion; referring to the shape of the nut of *Carya ovalis* var. *obovalis*.
- obtusiloba**—L. *obtus* (blunt) from *obtundere*, to blunt, and L. L. *lobus*, lobe, from the Gr. λοβός (lobos); referring to the rounded leaf-lobes of *Quercus obtusiloba* (synonym of *Q. stellata*).
- occidentalis**—L. (western) fr. *occidere*, to go down in reference to the sun. Name given by Linnaeus to *Thuja occidentalis* and *Celtis occidentalis*.
- odorata**—L. (fragrant) from *odor*, fragrance; referring to the fragrant foliage of *Carya ovalis* var. *odorata*.
- oeconomica**—L. (pertaining to the household) fr. the Gr. οἶκος (oikos), house, and νόμος (nomos), rule; referring to the use in the household of the fruit of *Prunus oeconomica* (synonym of *P. domestica*).
- officinale**—L. (a drug) fr. *officina*, a work shop; now referring to anything kept by druggists; used as the specific name of Sassafras because of the medicinal properties of this species.
- opaca**—L. (dark or opaque); referring to the dull green leaves of *Ilex opaca*.
- Osage orange**—fr. the tribal name of the Osage Indians—one of the Siouan tribes, and orange fr. the Skt. *maranga* through the L. *aurantium* (see *aurantiaca*). The common name of *Maclura pomifera* owing to the large, orange-shaped fruit.
- Osier**—fr. the L. L. *osaria*, a bundle of willow twigs, through the Fr. *osier* and the M. E. *osyere*. The common name of *Salix* spp.
- Ostrya**—L. (hornbeam), fr. the Gr. ὀστράα (ostrua), the Gr. common name of the tree.
- ovalis**—L. L. (egg-shaped), fr. *ovum*, egg; referring to the shape of the fruit of *Carya ovalis*.
- ovata**—L. (ovate or egg-shaped) fr. the Gr. ὠόν (oon), an egg, through the L. *ovum*; referring to the oval leaflets of *Carya ovata*.
- oxyacantha**—L. L. (sharply thorny) fr. the Gr. ὄξύς (oxus), sharp, pointed, and ἀκανθα (akantha), thorn; referring to the thorny branches of *Crataegus oxyacantha*.
- padus**—L. L. from the Gr. πάδος (pados), name of a tree, possibly *Prunus mahaleb*, transferred to *P. padus*; by some it is considered a distinct genus.
- palustris**—L. (boggy) fr. *palus*, swamp; referring to the low-land habitat of *Quercus palustris*.
- Pawpaw**—fr. the Caribbean *ababai*, through the Cuban *papaya*, the Sp. *papaya*, and the E. *pawpaw* (papaw). The common name of *Asimina triloba*.
- Paper Mulberry**—fr. the L. *papyrus* (see *papyrifera*) through the Fr. *papier*, and mulberry (which see). The common name of *Broussonetia papyrifera*, owing to the utilization of the bark for paper.
- papyrifera**—L. (paper-bearing) fr. the Egyptian word for a reed used in making paper and coming through the Gr. παπίρος (papiros), and L. *ferre*, to bear; referring to the papery bark of *Betula papyrifera* and to the fact that paper is made from the bark of *Broussonetia papyrifera*.

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- parvifolia**—L. L. (small-leaved) from *parvis*, small, and *folium*, leaf; referring to the small leaves of *Ulmus parvifolia*.
- Paulownia**—named for the Russian princess Anna Pavlovna, daughter of Paul I.
- Peach**—from the Pers. *pars* through the L. *persic* (which see), the Fr. *pesche*, and the M. E. *peche*. The common name of *Prunus persica*.
- Pear**—fr. the L. *pirum* or *pyrus* (which see), through the A. S. *peru*, and the M. E. *pere*. The common name of *Pyrus communis*.
- pedicellata**—L. L. (borne on a pedicel) fr. the L. L. *pedicellus*, in botany the stalk of a flower, diminutive of *pes*, *pedis*, foot; referring to the comparatively long flower-stalks of *Crataegus pedicellata*.
- pendula**—L. (drooping) fr. *pendere*, to hang; referring to the drooping branches of *Salix pendula* (synonym of *S. babylonica*), and *Betula pendula*.
- pennsylvanica**—L. L. (pertaining to Pennsylvania); referring to the range of *Fraxinus pennsylvanica* and *Prunus pennsylvanicum*.
- pentandra**—L. (five stamens) fr. the Gr. πέντε (pente), five, and ἀνδρῶς (andros), of the male; referring to the number of stamens of *Salix pentandra*.
- Pepperidge**—fr. the E. dialectic word for the Barberry. An early common name of *Nyssa sylvatica*.
- Persica**—L. (peach) fr. the Persian *pars*. This is the Plinian name of the Peach.
- Persimmon**—fr. the Virginian Indian word or the Algonquin *pasimine* in reference to the drying of the fruit fr. *pas*, to be dry. The common name of *Diospyros virginiana*.
- phellos**—L. name of *Quercus suber*, the Cork Oak, fr. the Gr. φέλλος (phellos), cork. Transferred by Linnaeus to *Q. phellos*.
- Picea**—L. (pine) fr. the Gr. πίσσα (pissa), pitch, through the L. *pix*. Transferred as the generic name for the spruce.
- Pine**—fr. the L. *Pinus* (which see), through the A. S. *pin*. The common name of *Pinus*.
- Pinus**—L. (pine) fr. the Skt. *pitu* through the Gr. πῖτος (pitos).
- Plane**—fr. the Gr. πλάτανος (platanos), through the L. *platanus* (which see), the Fr. and M. E. *plane*. The common name of *Platanus* spp., owing to the spreading branches and broad leaves.
- platanoides**—L. (sycamore-like) fr. the Gr. πλάτανος (platanos), the Plane Tree, and *oides*, like; referring to the resemblance of the leaves of *Acer platanoides* to those of the Plane Tree.
- Platanus**—L. (the sycamore) fr. the Gr. πλάτανος (platanos), broad; referring to the broad leaves and crown of the European species.
- Plum**—fr. the Gr. προῦμνον (proumnon) through the L. *Prunus* (which see), the A. S. *plume* (a change of r to l is not uncommon). The common name of a species of *Prunus*.
- pomifera**—L. (apple-bearing) fr. *pomum*, the apple, and *ferre*, to bear; referring to the nuts of *Carya porcina* (synonym of *Maclura pomifera*).
- Poplar**—fr. the L. *Populus* (which see), through the O. F. *poplier* and M. E. *poplere*. The common name of *Populus*.
- populifolia**—L. (poplar-leaf) fr. *populus*, Poplar, and *folium*, leaf; referring to the shape of the leaves of *Betula populifolia*.
- Populus**—L. (Poplar), the L. common name for the genus.
- porcina**—L. (pertaining to pigs) from *porcus*, pig; used in a derogatory sense, the nuts of *Carya porcina* (synonym of *C. glabra*) being inferior to those of other Hickories.
- prinoides**—fr. the Gr. πρίνος (prinos), the common name of the Holly Oak, *Quercus Ilex*, and *oides*, like; referring to the holly-like leaves of *Quercus prinoides*.
- prinus**—L. fr. the Gr. πρίνος (prinos), the ancient name of some evergreen tree, perhaps *Quercus Ilex*, transferred to *Quercus prinus* (synonym of *Q. montana*).
- procera**—L. (high, long); referring to the size attained by *Ulmus procera*.

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- prunifolium**—L. (plum-leaf) fr. *Prunus*, plum, and *folium*, leaf; referring to the shape of the leaves of *Viburnum prunifolium*.
- Prunus**—L. (plum-tree) fr. the Gr. πρῦνος (prunos), the common name of the plum tree.
- pseudoacacia**—L. (false-acacia) fr. the Gr. ψεύδος (pseudos), a falsehood, and ἀκακία (akakia), the Acacia, a thorn-tree of Egypt; referring to the similarity of the genus *Acacia* to *Robinia pseudoacacia*.
- Ptelea**—L. L. fr. the Gr. πτελέα (ptelea), the Elm, from (pteron), wing; referring to the winged fruit of the Elm, and transferred by Linnaeus to the present genus.
- pubescens**—L. (having hair) fr. *pubescere*, to grow hair; referring to the hairy organs of several species.
- pumila**—L. (dwarf), referring to the low habit of *Malus pumila*.
- punctata**—L. L. (dotted) fr. *punctum*, dot; referring to the dotted fruit of *Crataegus punctata*.
- purpurea**—L. (purple); referring to the color of the branches of *Salix purpurea*.
- pyrifolium**—L. L. (pear-leaved) from *pyrus*, pear, and *folium*, leaf; referring to the shape of the leaf of *Viburnum pyrifolium* (synonym of *V. prunifolium*).
- Pyrus**—L. (the pear). The L. common name for the pear.
- Quercus**—L. (oak) fr. the L. common name of the genus.
- racemosa**—L. (full of clusters) fr. *racemus*, clusters, and *-osus*, full of; referring to the racemose fruit of *Ulmus racemosa* (synonym of *U. Thomasi*).
- resinosa**—L. (full of resin) from *resina* through the Gr. ρητίνη (retine), resin, and *-osus*, full of; referring to the resinous quality of the wood of *Pinus resinosa*.
- Rhamnus**—L. L. (the buckthorn) fr. the Gr. ράμνος (rhamnos), the common name of the genus.
- Rhododendron**—L. fr. the Gr. ρόδον (rondon), a rose, and δένδρον (dendron), a tree; referring to the showy flowers of the genus.
- Rhus**—L. (the sumach) fr. the Gr. ρόυς (rhous), from ρέω (reo), to flow, the common name of the genus.
- rigida**—L. (stiff) fr. *rigere*, to be stiff; referring to the rigid habit of *Pinus rigida*.
- Robinia**—L. from the surname of John Robin, herbalist to Henry IV of France, who was first to cultivate the tree in Europe.
- rostrata**—L. (beaked) fr. *rodere*, to gnaw, through *rostrum*, the beak of a ship; referring to the long-attenuate fruit of *Salix rostrata* (synonym of *S. bebbiana*).
- Rowan Tree**—The Old English name of *Sorbus aucuparia*, from the same root from which the Sw. *ronn* and Icel. *reynir* are derived, and 'tree,' (which see).
- rubens**—L. (reddish) fr. *rubere*, to be red; referring to the color of the foliage or cones of *Picea rubens*.
- rubra (um)**—L. (red); referring to the color of the wood of *Quercus rubra* (synonym of *Q. borealis*), the reddish fruit of *Morus rubra*, and the autumnal color of the foliage of *Acer rubrum*.
- saccharinum**—L. (sweet) fr. *saccharum*, sugar; referring to the sweet sap of the Sugar Maple, applied by Linnaeus erroneously to the Silver Maple.
- saccharum**—L. (sweet or sugar) fr. the Skt. *carkara* through the Gr. σάκχαρον (sakcharon); referring to the sweet sap of *Acer saccharum*.
- Salix**—L. (willow) fr. the common name of the Willow.
- sambucifolia**—L. L. (elder leaved) from L. *sambucus*, from the Semitic *sabbka*, a musical instrument through the Gr. σαμβύκη (sambuke), and *folium*, leaf; referring to the elder-like leaves of *Fraxinus sambucifolia* (synonym of *F. nigra*).
- Sassafras**—L. L., perhaps from an early Indian name.
- scabra**—L. (rough) fr. *scabere*, to scratch; referring to the rough surface of the leaf of *Ulmus scabra* (synonym of *U. glabra*).

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- scopulina**—L. L. (shrubby, broom-like) fr. *scopula*, diminutive of *scopa*, slender branch, and *scopae*, broom; referring to the habit of *Sorbus scopulina* (erroneously identified with *S. decora*).
- Scots Pine—fr. the L. *scoti*, the name of a tribe in north Ireland which migrated to Scotland during the 5th century, hence the name Scotland, and Pine (which see). Geographical common name of *Pinus sylvestris*.
- serotina**—L. (late); referring to the late-flowering of *Prunus serotina*.
- sitchensis**—L. L. (of Sitka); referring to the range of *Sorbus sitchensis* (erroneously identified with *S. decora*).
- Sorbus**—L. (the Service Tree), given as a generic name for the Mountain Ash.
- speciosa**—L. (ornamental) fr. *specere*, to observe, through *species*, appearance, and *-osus*, full of; referring to the showy flowers of *Catalpa speciosa*.
- sphaeroidea**—L. (spherical) fr. the Gr. σφαῖρα (sphaira), sphere, and *oides*, like; referring to the globular cones of *Chamaecyparis thyoides*.
- spicatum**—L. (spicate) fr. *spicare*, to provide with a point or spike; in botany a spike is a racemose inflorescence with sessile flowers; referring to the narrow cylindrical inflorescence of *Acer spicatum*.
- spinosa**—L. (thorny) fr. *spina*, thorn, allied to *spice*, a point or ear of corn, and *osus*, provided with; referring to the prickles of *Aralia spinosa*.
- Spruce—abbreviation of Spruce-fir, fr. *Spruce*, a variant of O. E. *Pruce*, Prussia; the trunks of this Fir were valued as masts for ships and some were obtained from Prussia. The common name of *Picea*.
- stellata**—L. (covered with stars) fr. *stella*, star, fr. the Skt. *star*; in botanical Latin used in the sense of star-shaped or radiate; referring to the radiate terminal lobes of *Quercus stellata*.
- striatum**—L. (striped) fr. *striare*, to stripe; referring to the striped bark of *Acer striatum* (synonym of *A. pennsylvanicum*).
- strobis**—L., name of a Persian incense-bearing tree fr. the Gr. στρόβος (strobos) or στρόβιλος (strobilos), cone; used as the specific name of *Pinus strobus*.
- styraciflua**—L. (styrax-flowing) fr. the Gr. στύραξ (styrax), the Gr. name of *Styrax officinalis*, a tree yielding storax, a medicinal resin, and L. *fluere*, to flow; a similar resin is obtained from *Liquidambar styraciflua*.
- sulcata**—L. (furrowed) fr. *sulcare*, to furrow; referring to the ridges on the fruit of *Carya cordiformis*, described as *Juglans sulcata* by Willdenow; the latter name was transferred by Nuttall to *Carya* and erroneously used for another species now known as *C. laciniosa*.
- Sweet Bay—see "Bay"; the common name of *Magnolia virginiana* owing to its laurel-like leaves and sweet-scented flowers.
- Sycamore—fr. the Gr. σύκον (sukon), fig. and μόρον (moron), mulberry, through *sycamorus*, the ancient L. name of *Ficus sycamorus*; applied to *Platanus* owing to the similarity of the foliage, and also to *Acer pseudo-platanus*.
- sylvatica**—L. (belonging to the woods) fr. *silva*, a forest; referring to the habitat of *Nyssa sylvatica*.
- sylvestris**—fr. the L. *silvestris*, meaning of a wood or forest; referring to the habitat of *Pinus sylvestris*.
- syringaeifolia**—L. L. (lilac-leaved), fr. the L. L. *syringa*, lilac, and *folium*, leaf; referring to the shape of the leaf of *Catalpa syringaeifolia* (synonym of *C. bignonioides*).
- Tacamahac—fr. the Aztec *tecomahiyac* in reference to the resin of *Bursera tomentosa*, through the Sp. *tocamac* or *tacamahaca*, and the E. *tacamahac*. The common name of *Populus tacamahaca* owing to the resinous buds.
- tacamahaca**—L. L. for Tacamahac (which see).
- Thomasi**—genitive of the latinized surname Thomas; *Ulmus Thomasi* was named in honor of Daird Thomas (1776-1859), a civil engineer, who lived in Aurora, N. Y., and first described this elm as *Ulmus racemosa*.
- thorn—fr. the A. S. *þorn*, perhaps from the Skr. *trna*, a blade of grass.

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